"Making stillbirths visible: A systematic review of globally reported causes of stillbirth"

Short title: Global reporting of causes of stillbirth

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Abstract

Background

Stillbirth is a global health problem. The World Health Organization (WHO) application of the International Classification of Diseases for perinatal mortality (ICD-PM) aims to improve data on stillbirth to enable prevention.

Objectives

To identify globally reported causes of stillbirth, classification systems, and alignment with the ICD-PM.

Search strategy

We searched CINAHL, EMBASE, Medline, Global Health and Pubmed from 2009-2016.

Selection criteria

Reports of stillbirth causes in unselective cohorts.

Data collection and analysis

Pooled estimates of causes were derived for country representative reports. Systems and causes were assessed for alignment with the ICD-PM. Data are presented by income setting (low, middle and high income; LIC, MIC, HIC).

Main results

85 reports from 50 countries (489,089 stillbirths) were included. The most frequent categories were *Unexplained*, *Antepartum haemorrhage* and *Other* (all settings), *Infection* and *Hypoxic peripartum* (LIC), and *Placental* (MIC, HIC). Overall report quality was low. Only one classification system fully aligned with ICD-PM. All stillbirth causes mapped to ICD-PM. In a subset from HIC mapping obscured major causes.

Conclusion

There is a paucity of quality information on causes of stillbirth globally. Improving investigation of stillbirths and standardisation of audit and classification is urgently needed and should be achievable in all well-resourced settings. Implementation of the WHO Perinatal Mortality Audit and Review guide particularly across high burden settings is needed.

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Keywords

Stillbirth, classification, systems, cause of death, ICD

Tweetable Abstract

Urgent need to improve data on causes of stillbirths across all settings to meet global targets.

Lay abstract

Background and methods: Nearly 3 million babies are stillborn every year. These deaths have deep and long-lasting effects on parents, health care providers and the society. One of the major challenges to preventing stillbirths is the lack of information about why they happen. In this study we collected reports on the causes of stillbirth from high-, middle- and low-income countries to: 1. Understand the causes of stillbirth, and 2. Understand how to improve reporting of stillbirths.

Findings: We found 85 reports from 50 different countries. The information available from the reports was inconsistent and often of poor quality so it was hard to get a clear picture about what the causes of stillbirth are across the world. Many different definitions of stillbirth were used. There was also wide variation in what investigations of the mother and baby were undertaken to identify the cause of stillbirth. Stillbirths in all income settings (low-, middle-, and high-income countries) were most frequently reported as *Unexplained*, *Other* and *Haemorrhage (bleeding)*. *Unexplained* and *Other* are not helpful to understand why a baby was stillborn. In low-income countries, stillbirths were often due to *Infection* and *Complications during labour and birth*. In middle- and high-income countries stillbirths were often reported as *Placental complications*.

Limitations: We may have missed some reports as searches were carried out in in English only. The available reports were of poor quality.

Implications: Many countries, particularly where the majority of stillbirths occur, do not report any information about these deaths. Where there are reports, the quality is often poor. It is important to improve the investigation and reporting of stillbirth using a standardised system so that policy makers and healthcare workers can develop effective stillbirth prevention programs. All stillbirths should be investigated and reported in line with the World Health Organization standards.

Introduction

The global stillbirth rate (≥28 completed weeks' gestation) is estimated to be 18.4 per 1000 births[1] or around 2.6 million stillbirths each year[1]. The World Health Organization's (WHO's) Every Newborn Action Plan aims to reduce the stillbirth rate to 12 or fewer per 1000 births by 2030 in every country, and for countries already meeting this target to reduce equity gaps[2]. However, with an estimated annual reduction rate of 2.0% between 2000 and 2015[1], half that for neonatal deaths, progress has been slow. Identifying interventions to achieve such a target would be facilitated by cross-country and inter-country comparisons of the causes of stillbirth. Moreover, while national neonatal causes of death are regularly published through the United Nations[1,3], there is currently no systematic global reporting of causes of stillbirth. The WHO recommends use of the International Statistical Classification of Diseases and Health Related Problems (ICD) for classification of perinatal deaths for international reporting[4]. However, limitations in ICD for classifying stillbirths[5] has resulted in numerous disparate systems currently in use[6], thus limiting global comparisons. In 2016, WHO released ICD Perinatal Mortality (ICD-PM) as part of the WHO Perinatal Mortality Audit and Review guide[7]. The ICD-PM is an application of ICD and holds promise as an important step in improving global and local reporting of causes of stillbirths and neonatal deaths[8]. The ICD-PM aims to collect, at a minimum, timing of death and clinically defined causes and associated conditions.

Objectives

Following on the introduction of the ICD-PM, we aimed to identify globally reported causes of stillbirth in order to support progress toward the WHO Every Newborn Action Plan stillbirth rate target. The specific objectives were to:

1. Describe the current status of global reporting of stillbirth causes, including reported causes and classification systems used;
2. Pool results from country representative reports to identify commonly reported causes of stillbirth, stratified by income setting (high-, middle-, and low-income); and
3. Assess alignment of systems used and reported causes of stillbirths with the ICD-PM for country representative reports.

Methods

This systematic review was conducted and reported according to the PRISMA checklist[9]. The protocol has not been published. Two authors independently undertook screening of reports, selection, data extraction and quality assessment.

Eligibility criteria

All published and unpublished cohort and cross-sectional reports from 1 January 2009 to 31 December 2016 which presented causes of stillbirth were eligible. Reports were excluded if they: included non-consecutive or selected subgroups, e.g. preterm; aimed only to identify risk factors or did not provide data on causes in an extractable format (for complete study selection see Figure S1).

Information sources

We searched PubMed, Global Health, Cinahl, Medline and Embase without language restrictions. We identified national reports through web-based systematic searches (Appendix S1) and cross-referenced included reports.

Study selection

Titles and abstracts of identified reports were screened for eligibility; full text papers were retrieved if potentially eligible or unsure. All reports presenting causes of stillbirth were included to address Objective 1. To address Objectives 2 and 3, the most recent national report for each country was selected. If a national report was unavailable, a report was selected on criteria (in descending order): 1) population-based report with the largest number of stillbirths, 2) multi-centre health facility report covering the largest population.

Data extraction

A purpose built data extraction form was used. For details on data items and definitions used, see Additional Information S2.

Grouping reported stillbirth causes

The development of categories and mapping of reported causes of stillbirth to categories were undertaken by a panel including Maternal Fetal Medicine Specialists (GG, BS, DE), pathologist (RL) and epidemiologist (VF), with guidance from The Amsterdam Classification Workshop[10] members. Categories were created by "clustering" reported causes into 15 clinically meaningful groups for stillbirth prevention ("global categories") (Table S1). With the addition of *Placental conditions*, these categories generally coincided with previously suggested major causal groupings by Lawn et al[11]. We did not attempt to differentiate causes from associated conditions (Table S1).

Quality assessment

Quality assessment of country representative reports included in the pooled analysis of reported causes was performed using an adapted version of the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data[12] (Appendix S3). An overall quality rating was derived for each report (low, medium, or high quality). For subgroup analyses of "good" quality reports, we combined data from reports assessed as high and medium quality.

Data presentation and analysis

Data were presented by income setting using World Bank groupings[13] of low and lower-middle (LIC; Gross National Income (GNI) ≤$3,955), upper-middle (MIC; GNI $3,956- $12,235) and high (HIC; GNI ≥$12,236). Categories of stillbirth causes were presented as proportions of the total number of stillbirths classified. Results from country representative reports were statistically pooled to identify commonly reported causes stratified by country groupings. Analyses were done in R using the meta package[14] with 95% prediction intervals (PI)[15-17] (Appendix S4). Subgroup analyses by report quality and type of system (ICD versus clinical classification systems) were planned *a priori*. See Appendix S2 for definition of clinical classification systems[6] and criteria for alignment of classification systems with ICD-PM.

Each reported cause was mapped to the relevant ICD-PM major category. The ICD-PM includes five major maternal condition categories (M1-5) and 13 fetal categories, six with antepartum timing (A1-6) and seven with intrapartum timing (I1-7)[4]. For the Unknown (U) timing category we included the categories: U1: *Congenital malformations, deformations and chromosomal abnormalities*; U2: *Infection*; U3: *Other specified disorder*; U4: *Disorders related to fetal growth*; U5: *Death of unspecified cause*. We added one category, *Other*, to all timings to accommodate the causes without ICD-PM coding.

The proportions of stillbirths that could be mapped to a fetal cause and/or a maternal condition in ICD-PM were calculated. Mapping of data from good quality HIC reports to ICD-PM was compared descriptively with the 15 global categories.

Results

Of 7415 abstracts screened for eligibility, 909 full-text papers were reviewed for inclusion and 824 records were excluded: did not discuss stillbirth (396), no extractable data (217), sub-populations only (145), risk factors only (12) (for complete study selection see Figure S1). Eighty-five reports (LIC 28, MIC 20, HIC 37) with a total of 489,089 stillbirths were included in the review (LIC 13,197, MIC 431,216, HIC 44,676). Thirty-three country representative reports classifying 454,533 stillbirths were included in the pooled analysis of causes and mapping to ICD-PM.

Global stillbirth reporting

Description of included reports

The 85 included reports originated from 50 countries. Reports were published in English (66) and non-English (19; Table S2). Eleven reports excluded terminations of pregnancy. Half of the reports (including 2.4% of all stillbirths) were from hospital settings (LIC: 19 reports/7419 stillbirths; MIC: 8 reports/1134 stillbirths; HIC: 16 reports/3240 stillbirths) (Table 1, for full details see Table S2).

Definitions of stillbirth

Stillbirth was defined in 71 reports (84%) using 34 discrete definitions (Figure S2). The majority of HIC reports (78%) used a lower gestational age limit of 20-24 weeks while the majority of LIC reports (68%) used 28 weeks (Table 1).

Data available to classifiers

Systematic prospective perinatal mortality audits were used in 21 reports (LIC 2, MIC 4, HIC 15), of which 12 were hospital audits; seven used comprehensive investigation protocols (all from HIC) (Table S2). In 40 reports, retrospective audit data were used; 18 of these (LIC 2, MIC 6, HIC 10) sourced causes from Civil Registration and Vital Statistics (CRVS). Sixteen reports (LIC 13, MIC 3) were prospective studies; eight of these, all from LIC, used verbal autopsy. Reported autopsy rates in 20 reports [MIC 3 (14%), HIC 17 (47%)] ranged from 2.7% to 100%. In over half of the reports (55%) it was unclear whether autopsy had been performed. Placental pathology examination rates were included in 15 reports (18%) (none in LIC) with rates ranging from 22% to 100%. For full details on data available see Table S2.

Classification systems

Twenty-one clinical classification systems[18-38] were used in 41 of the 85 reports (LIC 15 reports/30% of stillbirths, MIC 6 reports/5% of stillbirths, HIC 20 reports/27% of stillbirths). The ICD was used more frequently in HIC (14 reports/72% of stillbirths) and MIC (7 reports/94% of stillbirths) than LIC (3 reports/2% of stillbirths) (Table 1). The remaining 20 reports listed causes of death without reference to any classification system. Areas of origin for the 21 clinical systems is shown in Table S3. Three-quarters of the systems allow a single primary cause of death, and half the systems allow associated factors to be recorded (Table S4). Five systems provide comprehensive definitions of causes[20,27,30-32] and 13 systems provide rules for assigning cause of death (See Table S4 for full details on clinical classification systems).

Globally reported categories of stillbirth

The 85 included reports presented causes of stillbirth using 860 unique terms. These were grouped into 15 global categories and 46 minor categories, of which eight major categories were common to over half (53%) of the reports (Table S5).

Congenital anomalies was the most frequently reported category, included in 93% of all reports. The proportion of stillbirths assigned to this category ranged from 1.4% in Nigeria[39] to 64.4% in China[40] (Figure 1, Table S5). The second category was *Unexplained,* included in 82% of all reports, ranging from 0.3% in Turkey[25] to 82.0% in Japan[41]. *Maternal conditions* were included in 64% of all reports, with frequency ranging from 0.6% in Ireland[42] to 36.5% in Italy[28] (Figure 1, Table S5).

The proportions of categories also differed across type of classification system. The most commonly reported categories for reports using the ICD included *Other unspecified condition* (68%

of reports) and *Hypoxic peripartum death* (64%), whereas for clinical systems these included *Antepartum haemorrhage* (72%) and *Infection* (67%).

Country representative reports

Description of included reports

Thirty-three reports classifying 454,533 stillbirths were included in the pooled analysis: seven LIC (5,629 stillbirths), 11 MIC (429,666 stillbirths), and 15 HIC (19,238 stillbirths). Twenty-one reports included ≥95% of total stillbirths in the country during the reporting period, one report included 72%, three included 6-49% and eight included ≤5% (Figure S3). In two reports (6%), terminations of pregnancy were excluded, and in 21 (64%), no reference was made to terminations. The ICD was used mainly in HIC and MIC reports (60% and 64%, respectively, versus 14% of LIC reports; Table 1, Table S2).

Quality assessment identified 13 good quality reports (29% of all LIC reports, 36% of all MIC reports, 47% of all HIC reports); only one of these was high-quality[43]. The remaining reports were assessed as low-quality (Table S6, Figure S4).

Pooled estimates of commonly reported causes of stillbirths

The top five categories by frequency for each country grouping are shown in Figure 2. *Unexplained* was the top category across all settings, with pooled estimated ranging from 31.2% to 43.7% (Tables S7, S8). Two additional categories were amongst the top five across all settings: *Other unspecified conditions* (9.3% to 11.6%) and *Antepartum haemorrhage* (8.4% to 9.3%; Tables S7, S9, S10). In LIC, *Infection* (15.8%) and *Hypoxic peripartum death* (11.6%; Tables S7, S11, S12) were also amongst the top five. In both HIC and MIC settings *Placental conditions* (14.4% and 13.7%, respectively) ranked in the top five, with C*ongenital anomalies* as the remaining category in HIC (14.0%) and *Specific fetal/pregnancy pathology* in MIC (11.0%) (Tables S7, S13, S14, S15).

Details of pooled analyses of *Umbilical cord complications, Maternal conditions, Spontaneous preterm, Hypertension, Fetal growth restriction* and *Terminations* are presented in Tables S16-S21.

Sub-group analysis

Due to insufficient data subgroup analysis by report quality was only possible for HIC. The proportion of *Unexplained* (15.4% vs 31.6%) and *Other unspecified conditions* (1.6% vs 9.3%) was lower in good quality reports versus all reports (Tables S8, S9). Subgroup analyses by system type showed higher proportions of *Antepartum haemorrhage* using clinical systems (14.1%) than using ICD (4.4%) in MIC (Table S10). Use of clinical systems resulted in lower proportions of *Other unspecified conditions* (1.6%) and *Unexplained* (17.7%) than use of ICD (13.2% and 43.4%, respectively) in HIC (Tables S9, S8).

Alignment with the ICD-PM

Alignment of clinical classification systems with the ICD-PM

Of 21 classification systems used, only Codac[19] was fully aligned with the ICD-PM. Four systems met two of the three criteria used to assess alignment, and 14 systems scored 0.5-1.5 out of a maximum of 3 (Table S3, Figure S5).

Mapping of reported causes to ICD-PM

Nearly all the 454,533 stillbirths reported in the 33 country representative reports were mapped to an ICD-PM fetal or maternal category, or both. Causes for 831 stillbirths (0.2%) mapped to ICD-PM neonatal rather than fetal codes (for example "neonatal aspiration syndrome"). 264,480 stillbirths (58%) were mapped to a fetal but not a maternal ICD-PM cause, and 140,319 (31%) to a maternal but not a fetal ICD-PM cause; 49,734 stillbirths (11%) were mapped to both (Tables S22, S23).

Of the 204,545 stillbirths in the global category *Unexplained*, 113,558 (56%) were mapped to the ICD-PM category *Unknown timing unspecified* (no maternal condition), 90,335 (44%) to *Antepartum hypoxia* (no maternal condition), 602 (0.3%) to *Antepartum unspecified* (no maternal condition), and 50 (0.02%) to maternal condition *Other complications of labour and delivery* (no fetal cause) (Tables S22, S23).

The global causes from best available data (good quality reports using clinical classification systems in HIC, five reports; 6,194 stillbirths) were mapped to ICD-PM. The global categories reflecting underlying placental causes of *Antepartum haemorrhage* and *Placental condition* (insufficiency) accounted for 20%, and *Intrauterine growth restriction* 7% of stillbirths (Figure 3). When mapped to the ICD-PM, these global categories are included within the major maternal category *Complications of placenta, cord and membrane*s and the fetal category *Disorders related to fetal growth,* accounting for 30% and 17% of stillbirths, respectively (Figure 3).

Discussion

Main findings

From 85 reports presenting causes of nearly half a million stillbirths from 50 countries and all income settings, we identified 15 major causal categories from nearly 900 causal terms; eight categories were common to the majority of reports. Despite this overarching commonality, we found wide variation in frequency of stillbirth categories and in the systems used to classify them with generally poor quality data. Underlining one of the key challenges of achieving the Every Newborn Action Plan stillbirth target, are the high proportions of stillbirths without information to guide prevention (*Unexplained* and *Other unspecified conditions)* in all income settings.

Strengths and limitations

We sought to include the most detailed causes of stillbirth available to allow identification of common groupings, and ultimately to enable consistent reporting across settings. In line with WHO

recommendations[4,44] and to maximize the utility of the data for prevention strategies, we excluded reports which assigned more than one cause of stillbirths and excluded all those reported as associated only. This may have resulted in a loss of information and limited our ability to assess the full value of the ICD-PM, which aim to record both a fetal and a maternal condition for every stillbirth. The need to assign multiple causes for some stillbirths has been highlighted. Further, the distinction between causes and associated conditions is often poorly defined[26] and in this review many reported "causes" are not recognised as causal conditions. Further, although we imposed no language restriction, we may have missed some reports due to English-language search terms.

Interpretation

Data quality

Data quality was generally poor with only a small number of reports based on high quality perinatal mortality audit. Further, many reports did not provide sufficient detail to adequately assess quality. Similar to others[1,5,45], we found global comparisons problematic due to differing definitions and systems. The inability to identify termination of pregnancies in reporting of stillbirth causes is problematic; many are terminated as a consequence of congenital anomalies[46], some of which may not have resulted in stillbirth.

Global causes of stillbirth

Results of the pooled analysis enabled comparisons of stillbirth causes across settings, providing additional evidence for key areas for prevention. The relatively high proportion of stillbirths attributed to intrapartum hypoxia (*Hypoxic peripartum*) in LIC versus HIC and MIC is in line with recent evidence from low- and middle-income countries (LMIC)[47,48] and confirms the urgency of improving care during labour and birth, when half of all global stillbirths occur[1,3,47,49]. Further, similar to other reports[47,48] we identified infection as a top cause of stillbirths in LIC, confirming the importance of infection prevention and management[3,49,50]. Our findings clearly highlight the importance of placental conditions as a major contributor to stillbirths in all settings, consistent with other recent studies[47,51]. However, many placental conditions were ill-defined and the causal link unclear (for instance delayed villous maturation)[52,53]. Many conditions that lead to stillbirth are also linked to neonatal deaths and therefore both must be accommodated within a single system to ensure optimal pregnancy care and outcomes[54].

ICD-PM and progress towards global reporting

We confirmed findings of other studies, showing numerous disparate systems for classification of stillbirths in use globally[5,45,55], further highlighting the need for a globally effective classification system. A recent consensus described user-identified characteristics for such a system[56], however no existing systems meet these characteristics[57]. Further, robust evaluation of system performance is limited[6]. The ICD-PM is the first system intended for global use in classification of perinatal

deaths[4,58-60], aiming to facilitate comparisons by improving perinatal mortality data, particularly in high burden settings. While evaluation of the performance of ICD-PM is currently limited, retrospective application to datasets in the UK and South Africa highlighted its values and provided insights to future improvements[59]. In our dataset, all causes of stillbirths reported globally could be accommodated within the ICD-PM. However, our mapping of causes from good quality reports in HIC using clinical classification systems highlights that classification system needs differ across settings. Meeting the needs of diverse settings is essential for global comparisons to identify important variation and inform programmatic change to reduce deaths.

The WHO Perinatal Mortality Audit and Review guide[7] provides a tool to initialize audits in low-income settings using the ICD-PM for classifying perinatal deaths. The ICD-PM maps ICD-10 codes to an underlying fetal cause of antepartum, intrapartum or unknown timing, and a maternal condition; thus, data collection must include timing as well as fetal and a maternal condition. While this approach aims to capture information on stillbirths from low resource settings (either cause and/or associated conditions) the ICD-PM faces challenges due to its ICD-10 provenance, including insufficient differentiation of causes from associated conditions, and insufficient detail on maternal conditions[8]. Conditions noted as Maternal in the ICD-PM include not only fetal underlying causes *(Placenta, cord and membranes)*, but also maternal causes (*Maternal complications of pregnancy*) and maternal associated conditions (*Maternal medical and surgical conditions*). Further, one-fifth of stillbirths in the global category *Unexplained* mapped to ICD-PM *Antepartum asphyxia*. Classifying associated conditions is important, particularly in data poor settings where assigning cause may be difficult. However confusing causes from associated conditions or mechanisms of deaths (antepartum asphyxia) while reducing the number of *Unexplained*, may obscure key areas for prevention. WHO is currently working towards ICD-11 which provides an opportunity to alleviate some of these issues[61].

Differences in proportions of causal categories across countries, were likely due to different classification approaches. Codac[19] was the only non-ICD system fully aligned with the ICD-PM. Although Codac has previously been shown to be the best-performing system[45], the majority of stillbirths classified using Codac were mapped to unknown timing and cause within the ICD-PM (data not shown). Codac also resulted in a high proportion of *Unexplained* stillbirths, potentially influenced by the categories included. Moreover, this system was only aligned with nine of the 17 user-identified characteristics for an effective global system. Future enhancements to global classification of stillbirths need to incorporate user-identified characteristics for an effective global system. Further, optimisation of information from data-rich settings to incorporate recent advances in stillbirth aetiology such as the consensus on placental pathology[53], and other detailed laboratory

investigations will serve to advance prevention of stillbirths globally. Implementation of any system must also be accompanied by appropriate training to ensure high-quality data.

Conclusion

To achieve the Every Newborn Action Plan global stillbirth rate target, improving care of women in labour and birth and preventing and treating infections and the quality of data on causes to drive change are priorities. Implementation of ICD-PM as part of the WHO Perinatal Mortality Audit and Review guide[7] would be a major step forward. While the ICD-PM captures data from high-burden settings by allowing for a minimum of timing and clinically defined causes and associated conditions, a global system must also accommodate needs of data-rich settings to enable global comparisons. Clearly ascertaining underlying causes separate from associated conditions and enabling capture of more detailed information in data-rich settings will fully harness the ICD-PM's potential for global reporting and prevention of stillbirths. Further research is needed to improve the classification of placental causes of stillbirths. Enhancements to global classification of stillbirths and neonatal deaths must be based on comprehensive testing across diverse settings.

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Contribution to Authorship

HR was responsible for the conduct of the study. VF conceptualized the study and developed methods and procedures with HR, MC and SHL. HR, VF, SHL, AW and ZT undertook searches, selection of studies, data extraction and quality assessment. GG, DE, RL and VF created the global stillbirth categories. MC oversaw all statistical aspects of the study and undertook the pooled analysis. VF and SHL undertook the assessment of ICD-PM alignment with advice from RP, JG, ÖT and EA. HR and VF were responsible for interpretation of findings and preparation of the first draft of the manuscript. SH, AW, GG, RL, DE, ZT, EA, HB, ED, JJE, FF, JG, KG, SG, AG, AH, YK, FK, JL, EM, JO, RP, KP, DS, RS, GS and ÖT have been actively involved throughout planning and consultation stages of the project and provided comments on the manuscript. HR, SHL, MC, SH, AW, GG, RL, DE, ZT, EA, HB, ED, JJE, FF, JG, KG, SG, AG, AH, YK, FK, JL, EM, JO, RP, KP, DS, RS, GS and ÖT approved the final version. All authors are part of The International Stillbirth Alliance Collaborative for Improving Classification of Perinatal Deaths.

Details of Ethics Approvals

Not required

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Figure 1. Proportion of stillbirths in each category for all studies

By income setting (85 reports; 489,089 stillbirths)

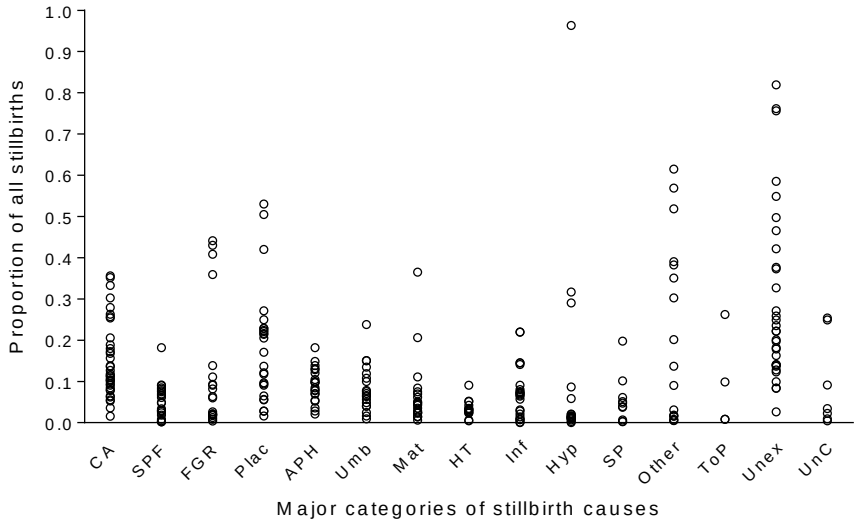


Figure 1a. Reports from high-income countries (HIC), 37 reports with 44,676 stillbirths

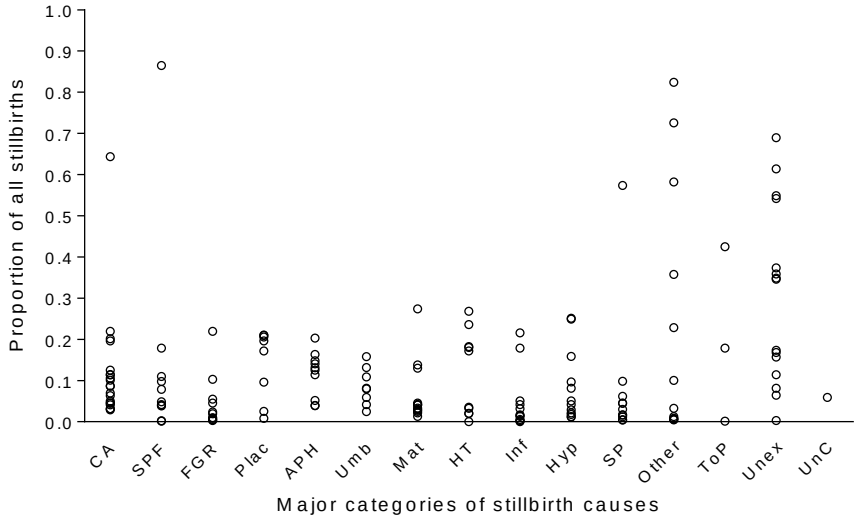


Figure 1b. Reports from middle-income countries (MIC), 20 reports with 431,216 stillbirths

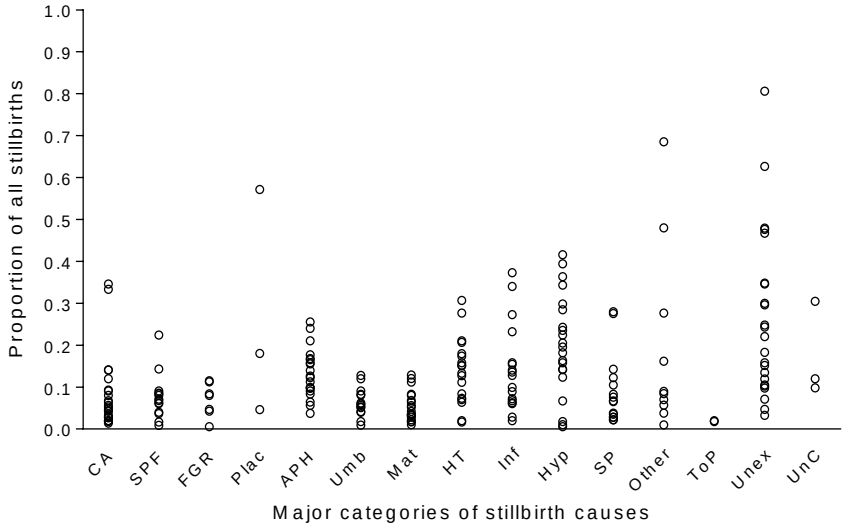
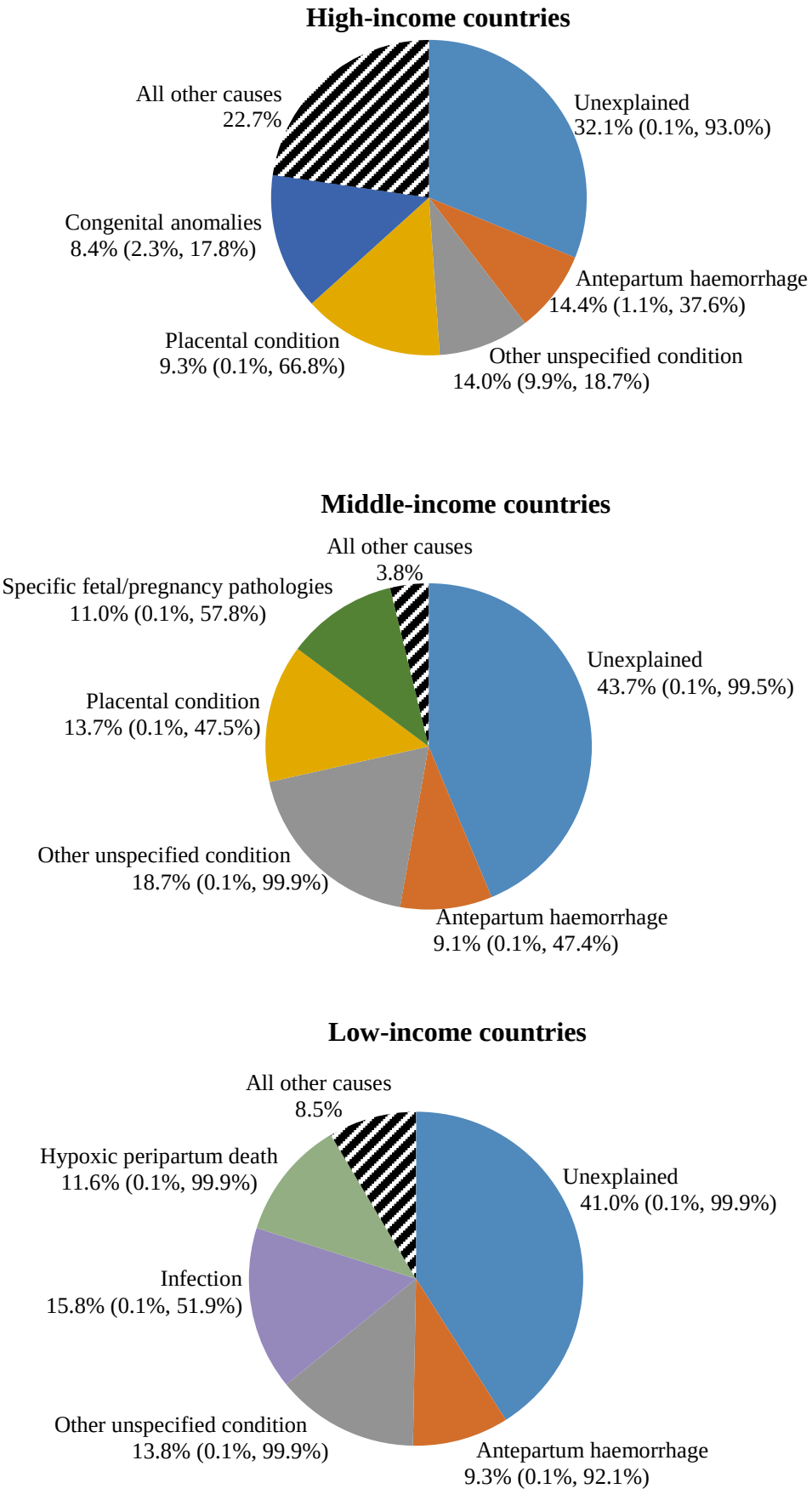


Figure 1c. Reports from low-income countries (LIC), 28 reports with 13,197 stillbirths

CA: congenital anomalies; SPF: specific fetal/placental condition; FGR: fetal growth restriction; Plac: placental conditions; Umb: umbilical cord; APH: antepartum haemorrhage; Mat: maternal conditions; HT: hypertension; Inf: infection; Hyp: hypoxic peripartum death; SP: spontaneous preterm; Other: other unspecified condition; ToP: termination of pregnancy, unspecified; Unex: unexplained; UnC: unable to classify

Figure 2: Top five pooled estimates of the global categories of stillbirth



Country-representative reports, by income setting (33 reports; 454,533 stillbirths). Data presented as point estimate (95% prediction interval).

Figure 2. Mapping of causes from good quality reports using clinical classification systems from high income countries

(5 reports; 6,194 stillbirths)

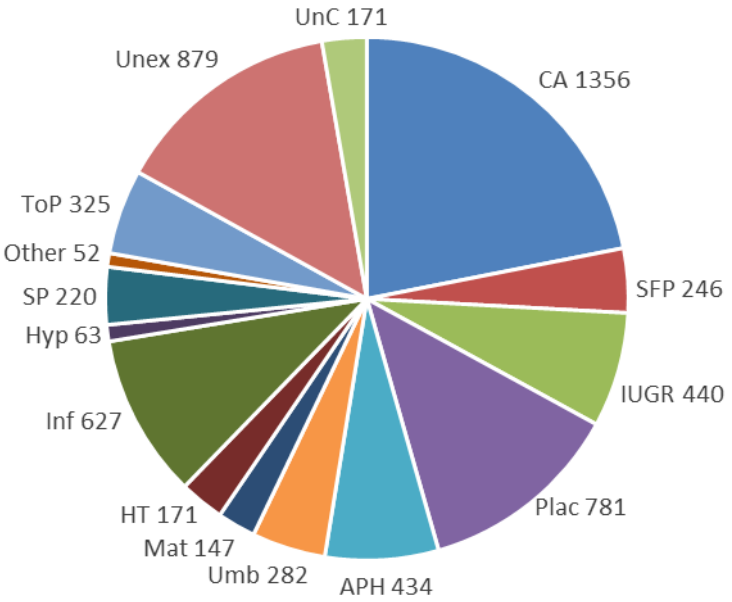


Figure 2a. Grouping of causes of stillbirths into 15 global categories

Maternal condition	M1: Complications of placenta, cord and membranes	M2: Maternal complications of pregnancy	M3: Oher complications of labour and delivery	M4: Maternal medical and surgical conditions	M5: No maternal condition identified	Total
Antepartum						
A1: Congenital malformations	0	0	0	0	0	0
A2: Infection	0	0	0	0	0	0
A3: Antepartum hypoxia	0	0	0	0	0	0
A4: Other specified antepartum disorder	0	0	0	0	0	0
A5: Disorders related to fetal growth	0	0	0	0	0	0
A6: Antepartum death of unspecified cause	21	0	0	0	597	618
A7: Other	0	0	0	0	0	0
Total	21	0	0	0	597	618
Intrapartum						
I1: Congenital malformations	0	0	0	0	0	0
I2: Birth trauma	0	0	0	0	2	2
I3: Acute intrapartum event	0	0	5	0	56	61
I4: Infection	208	0	0	0	0	208
I5: Other specified intrapartum	0	0	0	0	0	0
I6: Disorders related to fetal growth	0	1	0	0	187	188
I7: Intrapartum death of unspecified cause	0	0	0	0	0	0
I8: Other	0	0	0	0	0	0
Total	208	1	5	0	245	459
Unknown timing						
U1: Congenital malformations	0	0	0	0	1344	1344
U2: Infection	0	0	0	248	128	376
U3: Other specified disorder	90	0	0	59	405	554
U4: Disorders related to fetal growth	435	0	0	17	440	892
U5: Death of unspecified cause	0	0	0	0	511	511
U6: Other	0	0	0	0	0	0
Total	525	0	0	324	2828	3677
No fetal cause	1091	59	0	290	0	1440
Total	**1845**	**60**	**5**	**614**	**3670**	**6194**

Figure 2b. Stillbirths mapped to the ICD-PM matrix

CA: congenital anomalies; SPF: specific fetal/placental condition; FGR: fetal growth restriction; Plac: placental conditions; Umb: umbilical cord; APH: antepartum haemorrhage; Mat: maternal conditions; HT: hypertension; Inf: infection; Hyp: hypoxic peripartum death; SP: spontaneous preterm; Other: other unspecified condition; ToP: termination of pregnancy, unspecified; Unex: unexplained; UnC: unable to classify.

Table 1: Characteristics of included papers

By income setting (85 reports; 489,089 stillbirths)

	All reports				Country representative reports			
	HIC n=37	MIC n=20	LIC n=28	Total n=85	HIC n=15	MIC n=11	LIC n=7	Total n=33
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Countries included	20	14	15	49	15	11	7	33
Stillbirths classified	44,676	431,203	13,197	489,089	19,238	429,666	5,629	454,533
Stillbirth definition								
20-24 weeks	29 (78%)	10 (50%)	5 (18%)	44 (52%)	13 (87%)	4 (36%)	0	17 (52%)
28 weeks	2 (5%)	6 (30%)	19 (68%)	27 (32%)	2 (13%)	3 (27%)	4 (57%)	9 (27%)
Unknown	6 (16%)	4 (20%)	4 (14%)	14 (16%)	0	3 (27%)	2 (29%)	5 (15%)
Terminations								
Excluded	9 (24%)	2 (10%)	0	11 (13%)	2 (13%)	0	0	2 (6%)
Unknown	19 (51%)	14 (70%)	25 (89%)	58 (68%)	7 (47%)	8 (73%)	6 (86%)	21 (64%)
Multiple pregnancies								
Excluded	5 (14%)	1 (5%)	3 (11%)	9 (11%)	1 (7%)	0	1 (14%)	2 (6%)
Unknown	11 (30%)	12 (60%)	8 (29%)	31 (36%)	4 (27%)	8 (73%)	1 (14%)	13 (39%)
Setting								
Population based	21 (57%)	12 (60%)	8 (29%)	41 (48%)	15 (100%)	11 (100%)	6 (86%)	32 (97%)
Hospital based	16 (43%)	8 (40%)	19 (68%)	43 (51%)	0	0	1 (14%)	1 (3%)
Unknown	0	0	1 (4%)	1 (1%)	0	0	0	0
Language								
English	33 (89%)	7 (35%)	26 (93%)	66 (78%)	11 (73%)	2 (18%)	6 (86%)	19 (58%)
Non-English	4 (11%)	13 (65%)	2 (7%)	19 (22%)	4 (27%)	9 (82%)	1 (14%)	14 (42%)
Classification systems								
ICD	14 (38%)	7 (35%)	3 (11%)	24 (28%)	9 (60%)	7 (64%)	1 (14%)	17 (52%)
Clinical classification system	20 (54%)	6 (30%)	15 (54%)	41 (48%)	6 (40%)	2 (18%)	3 (43%)	11 (33%)
No system	3 (8%)	7 (35%)	10 (36%)	20 (24%)	0	2 (18%)	3 (43%)	5 (15%)

HIC: High-income countries; ICD: International Classification of Diseases; LIC: Low-income countries; MIC: Middle-income countries; Terminations: Termination of pregnancy

Appendix S1. Search string and systematic searches for national reports

1. perinat*
2. neonat*
3. fet*
4. foet*
5. intrapartum
6. intrauterine
7. intra-uterine
8. 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7
9. death*
10. dead
11. mortal*
12. demise
13. 9 OR 10 OR 11 OR 12
14. stillb*
15. 8 AND 13
16. 14 OR 15
17. audit*
18. inter-rater*
19. interrater*
20. classif*
21. caus* adj4 (death OR mortal* OR stillb*)
22. 17 OR 18 OR 19 OR 20 OR 21
23. 16 AND 22

Searches were undertaken for national reports and/or statistical data on perinatal mortality from countries across HIC, MIC and LIC, identified from the World Bank Group[1]. Reports were included where in-depth classification of cause of death was reported.

For routine national data, websites of the national statistical office and ministry of health were searched for the following countries: Australia, Canada, Chile, Croatia, France, Ireland, Japan, Kuwait, Lithuania, New Zealand, Poland, Portugal, Qatar, Sweden, United Kingdom, Argentina, Brazil, China, Colombia, Costa Rica, Ecuador, Mexico, Panama, South Africa, Thailand, Ghana, Guatemala, India, Nepal, Zambia, Bangladesh and Ethiopia. For each site, the key phrases: 'stillb*', 'fetal', and 'perinat*' were searched.

For countries with less accessible routine perinatal mortality data, a structured search was conducted within Google with key phrases searched in conjunction with each country. The key phrases included: stillbirth, fetal death, vital statistics; national data; rate/prevalence, statistics.

Additional national report data from Suriname was provided from Dr Hannah Blencowe from The Lancet Stillbirth Epidemiology Investigator Group [2].

Appendix S2. Data collection and definitions

Data collected:

The following data items were extracted for each of the included reports: country; language; year of data collection; setting (hospital (single- or multi-centre) or population based); stillbirth rate; total number of births; number of stillbirths in the cohort and numbers of stillbirths classified; whether termination of pregnancy and multiple pregnancies were included; the reported cause of death (verbatim); the type of data used to assign the cause of death; rates of autopsy and placental pathology; classification system used - name, whether the system used a hierarchical approach, the number of categories, whether the system was aligned with ICD-PM.

Definitions:

Alignment with ICD-PM: Data to assess alignment with ICD-PM was collected as follows: Whether the timing of death (antepartum or intrapartum) and a maternal as well as a fetal condition was identified for each case and whether ICD codes were used for these conditions.

Type of report: Reports were considered population-based if they reported national data or a total cohort of stillbirths within a defined region/district.

Clinical classification system: A clinical classification system was defined as "Any approach to classifying causes of stillbirths described by the authors of included publications as a 'system' or 'approach', and/or that included a clearly delineated list of causes separate from the data"[3].

Hierarchical: A system was considered hierarchical if it required causes to be assigned via consideration of each cause in sequence[3] and partially hierarchical if hierarchy was optional or incompletely defined.

Appendix S3. Checklist for quality assessment

	Yes	No	Unclear
1. Was the sample representative of the target population?			
2. Was the data analysis conducted with sufficient coverage of the identified sample?			
3. Were the study subjects described in detail?			
4. Were objective, standard criteria used for the measurement of the condition?			
5. Was the condition measured reliably?			
a. Adequate investigation of stillbirth?			
b. Adequate data source?			
c. Valid assignment?			

Adapted from the Johanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data[4]

1. <u>Was the sample representative of the target population?</u>

This question relies upon knowledge of the broader characteristics of the population of interest. For this study of causes of stillbirth, knowledge of at least the characteristics, demographics and medical history is needed. The term "target population" should not be taken to infer every individual from everywhere or with similar disease or exposure characteristics. Instead, give consideration to specific population characteristics in the study, including age range, gender, morbidities, medications, and other potentially influential factors. For example, a sample may not be representative of the target population if a certain group has been used (such as stillbirths occurring in hospital, or outside of hospital) and the results then inferred to the target population (i.e. whole population).

<u>Rules:</u>

Answer Yes if: a population based study.

Answer No if: population based study, but there was systematic exclusion that would have meant the cohort is not representative of the target population – for this study this means mainly congenital anomaly

2. <u>Was the data analysis conducted with sufficient coverage of the identified sample?</u>

A large number of dropouts, refusals or "not founds" amongst selected subjects may diminish a study's validity, as can low response rates for survey studies.

- Did the authors describe the reasons for non-response and compare persons in the study to those not in the study, particularly with regards to their socio-demographic characteristics?

- Could the not-responders have led to an underestimate of prevalence of the disease or condition under investigation?
- If reasons for non-response appear to be unrelated to the outcome measured and the characteristics of non-responders are comparable to those in the study, the researchers may be able to justify a more modest response rate.
- Did the means of assessment or measurement negatively affect the response rate (measurement should be easily accessible, conveniently timed for participants, acceptable in length and suitable in content).

Rules: **Answer Yes if:** causes of stillbirth were missing for <20% of the cohort

3. Were the study subjects and setting described in detail?

Certain diseases or conditions vary in prevalence across different geographic regions and populations (e.g. socioeconomic and maternal variables between countries and birth setting). Has the study sample been described in sufficient detail so that other researchers can determine if it is comparable to the population of interest to them?

Rules: **Answer Yes if:** the definition of stillbirth was provided and clear

4. Were objective, standard criteria used for the measurement of the condition?

Here we are looking for measurement or classification bias. Causes of stillbirth can be classified using different types of classification systems or International Statistical Classification of Diseases and Related Health Problems (ICD). The causes assigned should also reflect the underlying cause and not only state conditions (e.g. ICD).

Rules: **Answer is Yes if:**

- ICD was used

  OR

- clinical system which provided good definitions and rules for use (based on Leisher et al[3])

  OR

- the study used an informal list of conditions and included definitions and rules that enable anyone to apply the system to stillbirths

5. Was the condition measured reliably?

Considerable judgment is required to determine the presence of some health outcomes. Having established the objectivity of the outcome measurement instrument, it is important to establish how the measurement was conducted.

Rules: If Yes to all then answer Yes to overall item. Otherwise use the majority of No or Unclear as the answer. If Yes on two items including item 5a, Yes can be assigned to the overall criterion.

5a: Adequate investigation of stillbirth?

Answer Yes if:

- HIC: both autopsy and placenta pathology rates >75%.

OR

- LMIC Verbal Autopsy was performed in LMIC.

5b: Adequate data source?

Answer Yes if:

- Verbal Autopsy

OR

- Prospectively collected clinical data for the purposes of classification of causes of death (No if death certificate data only used and/or Vital registration data)

5c: Valid assignment?

Answer Yes if: <50% unexplained and <20% Other unspecified

Overall quality rating algorithm

HIGH QUALITY REPORTS: YES on all criteria.

MEDIUM QUALITY REPORTS: must fulfil <u>all</u> of the following:

- 1 = Unclear or Yes
- 2 = Unclear or Yes
- 4 = Unclear or Yes
- At least one of 5a, 5b, 5c = Yes

Reports that do not fulfil criteria for HIGH or MEDIUM are classified as LOW.

Appendix S4. Statistical methods for pooled estimates of reported causes

In general, the goal of a meta-analysis is not only to report the pooled estimate, but also to report how the results in the various individual studies are dispersed about the pooled estimate. One standard measure of dispersion (heterogeneity) in a meta-analysis is I^2. As pointed out by Higgins, I^2 is not an absolute measure of dispersion, but the proportion of total (observed) variation in the point estimates that is attributable to between-study variation[5]. For meta-analyses of cohort/observational studies, I^2 might not be particularly informative because the sample size is large and therefore the within-study variation is small; that is, almost all of the observed variation is between-study variation. For this present meta-analysis, the number of stillbirths in the identified studies was large, with a long tail to the right (median=300 stillbirths, mean=14670, inter-quartile range: 140, 1496). Unsurprisingly, I^2 for each of the individual causes-of-stillbirth was >90% (available on request); and, therefore not particularly informative. Another measure of dispersion/variation is $\tau 2$. However, a direct public-health interpretation of $\tau 2$ can be difficult; especially, as if often the case for meta-analyses, the analysis is on a transformed scale[6]. Therefore, we report 95% prediction intervals[6-8]. Prediction intervals are different from (e.g., typically wider than) confidence intervals and provide a direct measure of dispersion on the same scale the point estimates. The prediction interval tells us that if we were to select a hypothetical study at random from the same hypothetical universe of studies as those in the meta-analysis; then, in 95 of 100 hypothetical studies, the true outcome of interest in that study would fall in the range given by the prediction interval. Wide prediction intervals therefore tell us that different studies have reported widely different point estimates.

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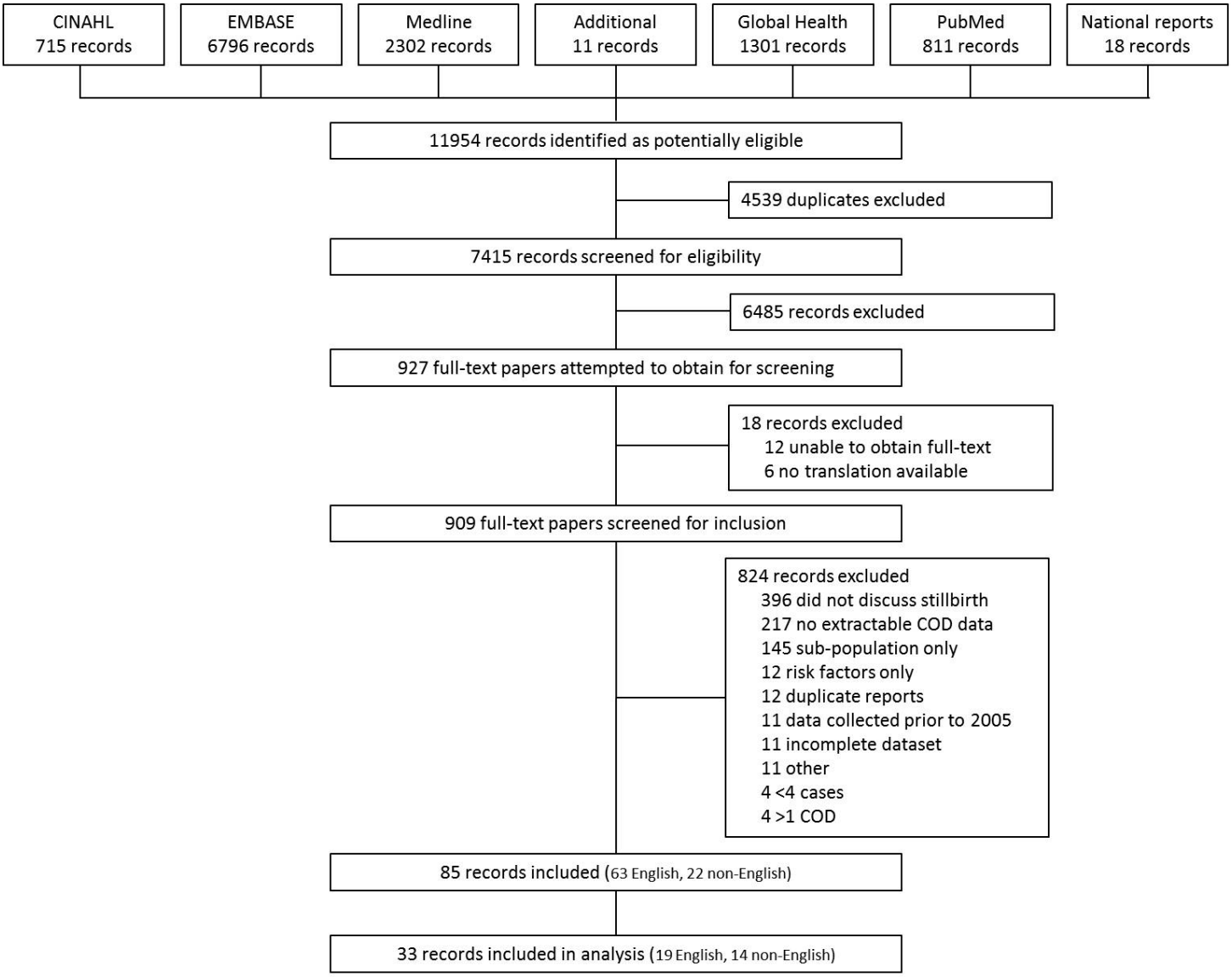

Figure S1. Flow diagram of study selection

Other included: Characteristics/clinical circumstances/avoidable factors instead of cause of death (COD) (3), no original data (3), self-citation (1), estimates only (1), no intent to classify (2), pregnancies from 12 weeks' GA (1).

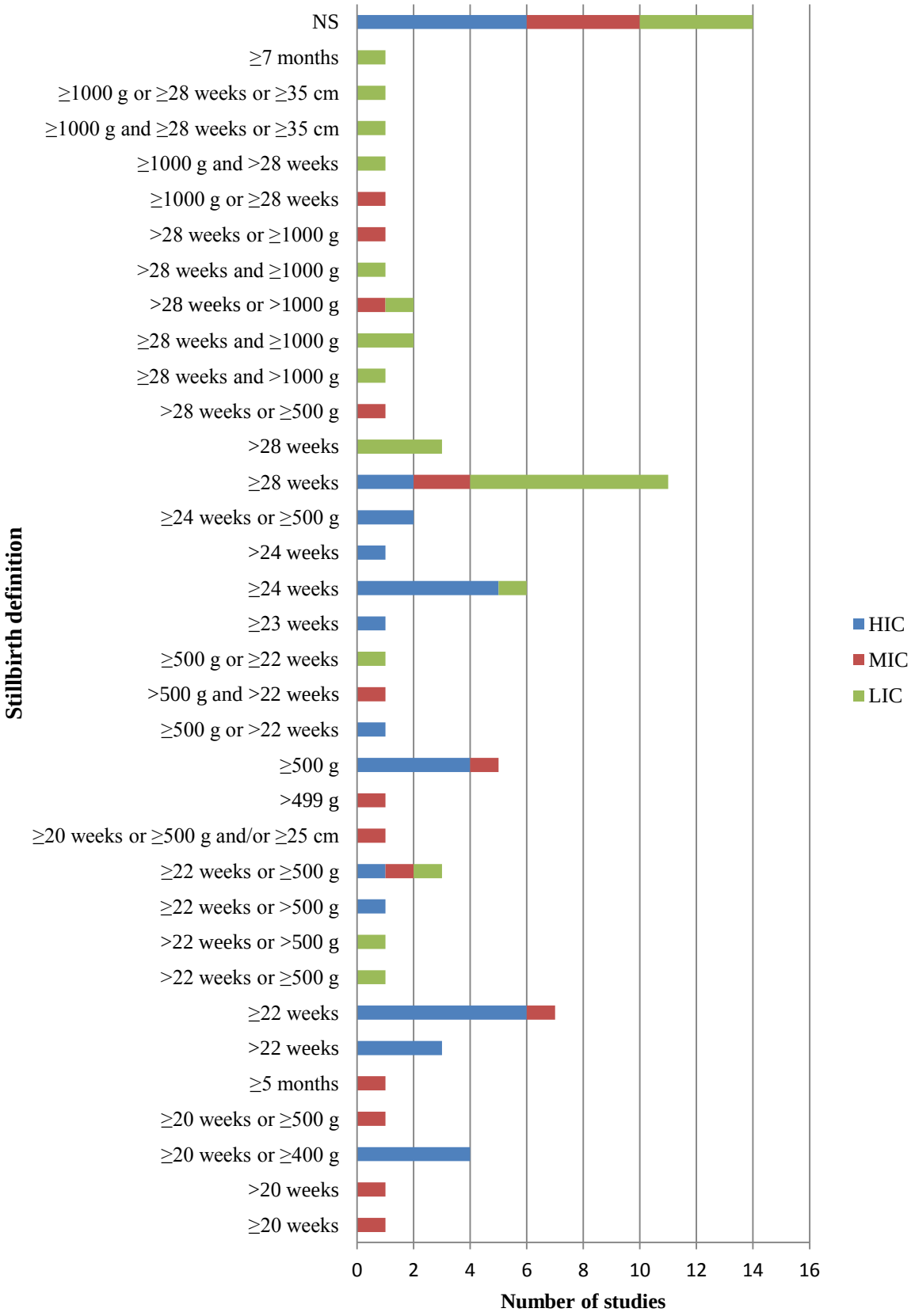

Figure S2. Stillbirth definitions in included reports

Total reports: n=85; HIC: High income countries, n=37; MIC: Middle income countries, n=20; LIC: Low income countries, n=2

Figure S3. Proportion of national stillbirths included in country representative reports

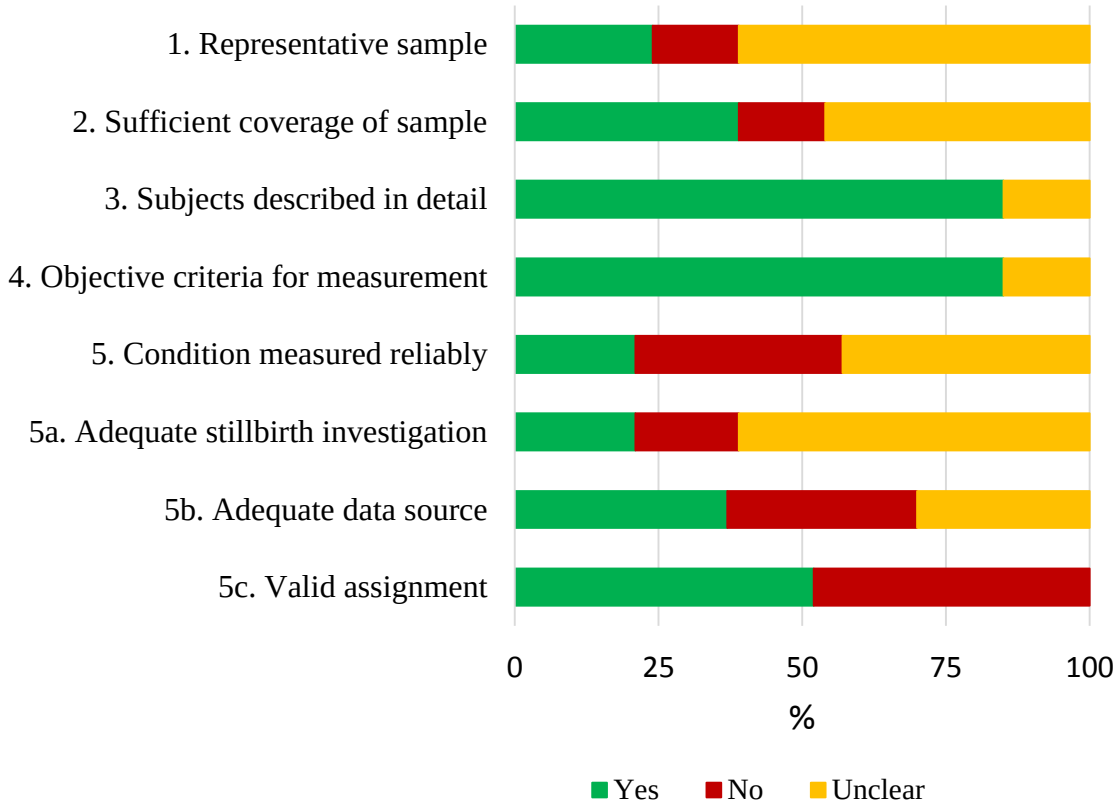

Figure S4. Quality assessment summary

Country-representative reports included in pooled estimates of global causes of stillbirth (n=33)

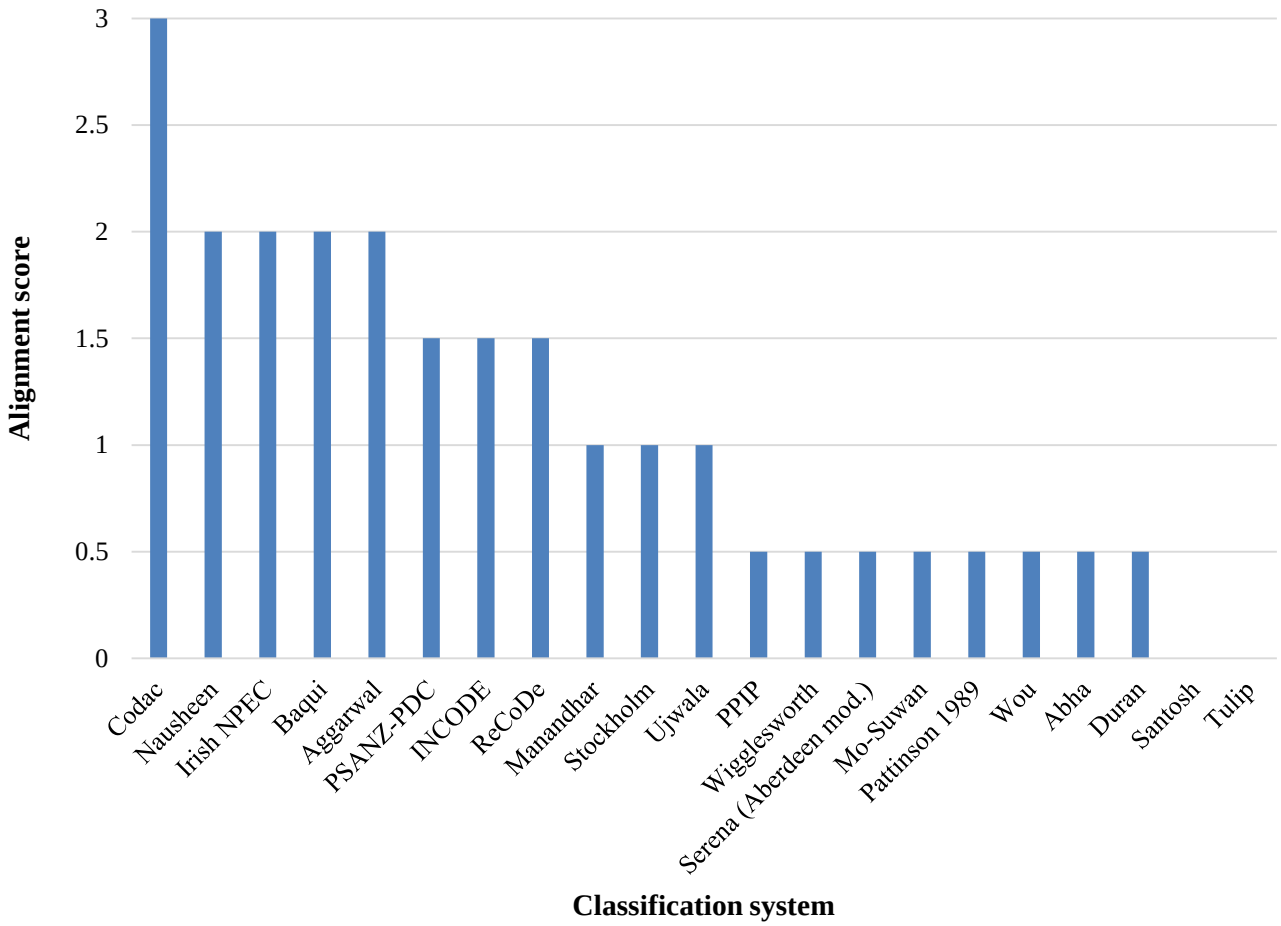

Figure S5: Alignment of 21 stillbirth classification systems with the ICD-PM

Total score (maximum=3) is the sum of scores for (1) requires distinguishing between antepartum and intrapartum stillbirth (yes, 1; partially, 0.5; no, 0); (2) allows both fetal and maternal conditions to be recorded (yes, 1; no, 0); and (3) uses ICD codes (yes, 1; no or unclear, 0).

Table S1. Mapping of reported causes of stillbirth into categories

Category	Sub-category 1	Sub-category 2	Causes reported
1. Congenital anomalies	**1.1 Central Nervous System**		Congenital malformations of the nervous system Congenital malformations of the brain Congenital malformation of the spinal cord, unspecified Anencephaly and similar malformations Atresia of foramina of Magendie and Luschka Hydrocephaly Congenital hydrocephalus Hydrocephalus with meningocele Hydrocephalus and spina bifida Thoracic spina bifida without hydrocephalus Spina bifida Occipital encephalocele Encephalocele non specified Microcefalia Hydromyelia Congenital malformations of the corpus callosum Congenital brain cysts Arnold-Chiari syndrome Other hypoplastic brain abnormalities Holoprosencefalia Intracranial non-traumatic haemorrhage of the fetus
	1.2 Genetic abnormalities	**1.2.1 Chromosomal**	Chromosomal Chromosomal disorders Downs syndrome and other chromosomal abnormalities Downs syndrome Trisomy 21, mosaicism (mitotic nondisjunction) Trisomy 18, due to lack of meiotic disjunction Trisomy 18 (isolated or with other anomalies) Trisomy 21 (isolated or with other anomalies) Edwards syndrome Edward's syndrome and Patau's syndrome Patau syndrome, unspecified Turner syndrome
		1.2.2 Unspecified	Trisomies Aneuploidy Chromosomal abnormality, unspecified Chromosomal abnormalities, not elsewhere classified Other trisomies and partial trisomies of the autosomes, not elsewhere classified
	1.3 Cardiovascular system		Congenital malformations of the circulatory system Cardiovascular system Cardiovascular disorders originating in the perinatal period Congenital malformations of the heart Congenital malformation of cardiac chambers and connections Tetralogy of Fallot Ebstein Anomaly Complex congenital heart disease

Category	Sub-category 1	Sub-category 2	Causes reported
			Pulmonary vascular anomalies Congenital malformations of cardiac septa Congenital malformations of aortic and mitral valves Defect of the atrial septum Coarctation of the aorta Atrioventricular septal defect Congenital malformations of the tricuspid valve Congenital malformations of pulmonary and tricuspid valves Congenital aortic valve insufficiency Left heart hypoplasia syndrome Triauricular heart Congenital heart block Discordance of ventriculoarterial connection Ventricle with double inlet Atrioventricular discordance connection Other congenital malformations of the pulmonary artery Congenital malformations of great arteries Congenital malformations of peripheral vascular system Arteriovenous malformation of cerebral vessels Heart disorder Neonatal cardiac dysrhythmia
	1.4 Musculoskeletal		Musculoskeletal system Congenital malformations of the musculoskeletal system Congenital malformations of spine and bony thorax Other congenital malformations of the osteomuscular system Craniosynostosis Thanatophore dwarfism Skeletal Thanatophoric dysplasia Achondroplasia Osteochondrodysplasia with defects of growth of long bones and spine Other osteochondrodysplasias Dolichocephaly Osteogenesis imperfecta
	1.5 Thoracic		Respiratory system Diseases of the respiratory system Congenital malformation of respiratory system, unspecified Diaphragmatic hernia Respiratory and diaphragm Congenital diaphragmatic hernia Congenital malformations of the lung Other congenital malformations of the larynx Congenital pulmonary cyst Other congenital malformations of trachea Congenital hypoplasia and dysplasia of lung
	1.6 Abdominal/Gastrointestinal		Congenital malformation of the upper gastrointestinal tract, unspecified Other specific perinatal digestive system disorders

Category	Sub-category 1	Sub-category 2	Causes reported
			Other congenital malformations of digestive system Gastro-intestinal system Congenital malformation of the stomach, unspecified Gastroschisis Exomphalos Omphalocele and imperforated anus Congenital absence, atresia and stenosis of small intestine Esophageal atresia without mention of fistula Congenital malformation of intestine Congenital malformations of gallbladder, bile ducts and liver Congenital malformations of esophagus Absence, atresia and congenital stenosis of the small intestine, unspecified part Absence, atresia and congenital stenosis of other parts of the large intestine Congenital malformations of bowel fixation Cystic disease of the liver Other congenital malformations of liver
	1.7 Metabolic		Transitory disorders of carbohydrate metabolism specific to fetus and newborn Specific transient endocrine and metabolic disorders of the fetus and newborn Metabolic disorders
	1.8 Urogenital		Congenital malformations of genito-urinary system Urinary system Other congenital malformations of bladder and urethra Hypospadias Renal agenesis Renal agenesis and other reduction defects of kidney Other atresia and stenosis of urethra and bladder neck Congenital hydronephrosis Polycystic kidney, autosomal recessive Polycystic kidney, unspecified type Cystic kidney disease Congenital solitary renal cyst Congenital malformations of the kidney Renal dysplasia Cystic renal dysplasia Renal and urinary tract diseases Renal hypoplasia, unspecified Renal, unilateral hypoplasia Potter Syndrome
	1.9 Other congenital anomalies		Other conditions of integument specific to newborn Multiple congenital malformation Multiple/non-chromosomal syndromes Other specified congenital malformation syndromes affecting multiple systems Other specified congenital malformation syndromes, not elsewhere classified Other congenital malformation syndromes due to known exogenous causes Cleft palate with unilateral cleft lip, unspecified

Category	Sub-category 1	Sub-category 2	Causes reported
			Cleft palate, unspecified Cleft lip, unilateral Congenital malformation syndromes predominantly affecting facial appearance Other congenital malformations of skull and face bones Other congenital malformations of skull and face Congenital malformations of face and neck Other congenital deformities of the skull, face and jaw Other congenital malformations of tongue, mouth and pharynx Other branchial cleft malformations Nager syndrome Other congenital malformations of ear Syndactyly Macrocephalia Congenital malformations of the spleen Congenital malformation syndromes predominantly involving limbs Congenital malformation of bony thorax, unspecified Hemangioma and lymphangioma, any site Dysmorphic syndrome Haematological Tumours Haemorrhagic and haematological disorders of the fetus Congenital ichthyosis Neoplasm of uncertain behavior of other and unspecified site Neoplasms Other congenital malformations not elsewhere classified Other specified congenital abnormality Other congenital malformations
	1.10 Unspecified		Other congenital anomalies Congenital anomalies Congenital deformities Defect Malformations of the fetus Congenital malformations, deformations and chromosomal abnormalities Congenital malformations, deformations and chromosomal abnormalities Malformation and/or chromosomal abnormalities Unspecified congenital abnormality Structural abnormalities Congenital defect/malformation Birth defect Lethal congenital anomaly Malformation incompatible with vitality (intern hydrocephalia, the transposition of main vessels, gastroshisis etc) Fetal anomalies Fatal congenital malformations Amniotic band Developmental defects Abnormality (including termination for fetal abnormality)

Category	Sub-category 1	Sub-category 2	Causes reported
2. Specific fetal/pregnancy pathology	**2.1 Complications of multiple pregnancy**	**2.1.1 Twin twin transfusion**	Fetus -twin-twin transfusion Fetus and newborn affected by placental transfusion syndromes Acardiac fetus
		2.1.2 Other complications	Twin 1 dies in uterus Monoamniotic twin Twins Multiple birth related Retained second twin Fetus and newborn affected by multiple pregnancy Fetal hemorrhage into the other twin Siamese Twins
	2.2 Hydrops		Fetal hydrops Non-immune hydrops Non-immune hydrops with imperforate anus Idiopathic hydrops Hydrops fetalis not due to haemolytic disease
	2.3 Iso-immunization		Hemolytic disease of newborn Hydrops fetalis due to haemolytic disease Other hemolytic disease of the fetus and newborn Fetal hydrops due to incompatibility Rh Incompatibility fetus and newborn Alloimmune disease: Unspecified Alloimmune disease: Rhesus Alloimmune disease: Alloimmune thrombocytopenia Alloimmune disease: Other Iso-immunization Immunization
	2.4 Amniotic fluid abnormalities		Oligohydramnios Polyhydramnios Amniotic fluid -other
	2.5 Uterine		Uterine anomalies Ruptured uterus Uterine rupture before labour Uterus-obstructed Uterus bicorne Another duplication of the uterus Uterine complication
	2.6 Other		Fetal coagulopathy Special causes (blood group incompatibilities, hydrops fetalis, congenital metabolic disease, twin-to twin transfusion, tumor etc.). Disseminated intravascular coagulation in the fetus and newborn Other perinatal hematological disorders Other specified fetal and neonatal haemorrhages Intracranial non-traumatic hemorrhage of fetus and newborn Intraventricular hemorrhage (nontraumatic) of the fetus and newborn, unspecified Intracerebral hemorrhage (nontraumatic) of the fetus and newborn Subarachnoid hemorrhage (nontraumatic) of the fetus and

Category	Sub-category 1	Sub-category 2	Causes reported
			newborn Intracranial non-traumatic haemorrhage of fetus and newborn Other (nontraumatic) intracranial hemorrhage of fetus and newborn Cutaneous neonatal hemorrhage Fetal subdural haemorrhage Fetal blood loss Fetus and newborn affected by ectopic pregnancy Fetal shock Conditions associated with tegumentary regulation and temperature of the fetus and newborn Fetus affected by condition related to the current pregnancy Other respiratory affections of the newborn Other respiratory conditions originating in the perinatal period Neonatal aspiration syndromes Primary atelectasis of newborn Respiratory distress of newborn Other chronic respiratory diseases originating in the perinatal period Meconium aspiration Fetus affected by condition related to the current pregnancy Meconium plug syndrome Rupture of membranes after amniocentesis Intestinal obstruction of newborn, unspecified Neonatal aspiration of amniotic fluid and mucus Other specific perinatal conditions, unspecified Other disorders originating in the perinatal period Other specific perinatal conditions (includes iatrogenic conditions such as rupture of membranes after amniocentesis, termination of pregnancy for suspected but unconfirmed congenital abnormality) Other specific fetal problem Other fetal pathologies Other fetal condition Neonatal Fetal
3. Intrauterine growth restriction/Small for gestational age			Intrauterine growth restriction IUGR-suspected antenatally IUGR-observed at delivery Intrauterine growth retardation Fetal growth restriction/IUGR Fetal growth restriction FGR-no placental pathology FGR-no examination of placenta FGR-unspecified or not known whether placental examined Foetal restricted growth Fetal growth retardation, unspecified Slow fetal growth Disorders related to duration of pregnancy and fetal growth Disorders related to fetal growth Fetal growth retardation, fetal malnutrition, short gestation and low birth weight

Category	Sub-category 1	Sub-category 2	Causes reported
			Disorders of newborn related to slow fetal growth and fetal malnutrition Low weight for gestational age Small for gestational age Unexplained small size for gestational age Poor fetal growth, short gestation
4. Placental conditions	**4.1 Placental insufficiency**		Placental insufficiency FGR with evidence of reduced vascular perfusion FGR -other specified placental pathology Unexplained antepartum death -with evidence of reduced vascular perfusion IUGR/placental insufficiency Placental insufficiency/infarction FGR -other specified placental pathology Birth asphyxia/placental insufficiency FGR with chronic villitis Maternal vascular malperfusion Placental infarction
	4.2 Fetomaternal haemorrhage		Feto-maternal haemorrhage
	4.3 Other		Placenta Placental conditions Acute placental pathology Placental disease Fetus and newborn affected by other morphological and functional abnormalities of the placenta and unspecified Delayed placental villus maturation Fetus affected by complications of placenta, umbilical cord and membranes Disorder of the placenta, amniotic sac, cord, cervix Placenta/ cord/ membrane Acute placental pathology Placental disorders Villitis Unexplained antepartum death with chronic villitis Fetal vascular malperfusion Choriocarcinoma Congenital absence and hypoplasia of umbilical artery Complications of placenta: abruptio placenta and placenta praevia or other anomalies of placenta or fetal membranes Membrane disorders Fetus and newborn affected by other abnormalities of membranes Fetus and newborn affected by other and unspecified morphological and functional abnormalities of placenta (dysfunction, infarction, insufficiency) Vasculopathy Decreased uteroplacental blood flow
5.Antepartum haemorrhage	**5.1. Abruption**		Placental abruption Placental abruption with laboratory evidence of thrombophilia Decolman placenta
	5.2. Placental praevia		Placenta previa Praevia with APH

Category	Sub-category 1	Sub-category 2	Causes reported
	5.3. Other antepartum haemorrhage		Antepartum hemorrhage of unknown origin Antepartum haemorrhage Accidental hemorrhage with hypertension Accidental hemorrhage without hypertension Fetus affected by other placental separation/hemorrhage Maternal hemorrhage Other antepartum haemorrhage Antenatal bleeding Vasa praevia
	5.4. Unspecified		APH of undetermined origin Prepartum hemorrhage Uncertain haemorrhage APH/anaemia Ante/intrapartum haemorrhage
6. Umbilical cord	**6.1 Cord prolapse**		Prolapsed cord Cord prolapse/complication Intrapartum complication - cord prolapse Cord compromise/prolapse
	6.2 Cord entrapment		Fetus affected by other compression of umbilical cord Cord around neck Tight nuchal cord Nuchal cord Umbilical cord -tight Abnormal umbilical cord twisted around neck or corps or other anomaly of the cord
	6.3 Knots, Torsion, Strictures		Umbilical cord-true knot True knot with evidence of occlusion Umbilical cord -constricting loop or knot Other cord entanglement or knot
	6.4 Other cord complications		Umbilical cord complications Fetus and newborn affected by other complications of umbilical cord and unspecified Umbilical cord diseases Antepartum cord complications Irregularity of umbilical cord Velamentous insertion Velamentous cord Cord haemorrhage Umbilical cord conflict Cord accident Umbilical cord –other Bleeding from the umbilicus Cord pathology Cord Umbilical cord abnormalities Cord thrombosis Umbilical cord origin
7. Maternal conditions	**7.1 Diabetes/gestational diabetes**		Gestational diabetes Diabetes mellitus Pregnancy-induced diabetes

Category	Sub-category 1	Sub-category 2	Causes reported
			Diabetes/hypertension Syndrome of the newborn of diabetic mother
	7.2 Lupus or antiphospholipid syndrome		Lupus or antiphospholipid syndrome or thrombophilia Thrombophilias Antiphospholipid antibody syndrome
	7.3 Cholestasis		Cholestasis Intrahepatic cholestasis of pregnancy Obstetric cholestasis
	7.4 Maternal trauma		Maternal accident Fetus and newborn affected by maternal trauma Non-accidental Accidental Trauma Trauma-external Accident or external condition
	7.5 Other specified conditions		Anemia in pregnancy Other specified maternal conditions Sickle cell anemia Mother-heart disease Thyroid disease Mother-jaundice Coagulation disorders Drug Misuse Maternal pyrexia Fetus and newborn affected by maternal drug addiction Fetus and newborn affected by maternal smoking Fetus and newborn affected by maternal alcoholism Underlying maternal illness (including chronic hypertension, epilepsy, renal disease, liver disease and DM) Fetus and newborn affected by other harmful influences of the mother Newborn (suspected to be) affected by noxious substances transmitted via placenta Fetus and newborn affected by maternal nutritional disorders Newborn (suspected to be) affected by noxious substances transmitted via placenta or breast milk Fetus and newborn affected by other maternal conditions Fetus and newborn affected by noxious influences of mother, unspecified Maternal-other endocrine conditions Fetus and newborn affected by other medical procedures on mother, not elsewhere classified Fetus and newborn affected by maternal death Fetus and newborn affected by other circulatory and respiratory diseases (Mother)
	7.6 Other unspecified conditions		Newborn (suspected to be) affected by maternal conditions that may be unrelated to present pregnancy Newborn (suspected to be) affected by maternal complications of pregnancy Maternal conditions Maternal disorders Mother- other Maternal medical conditions

Category	Sub-category 1	Sub-category 2	Causes reported
			Maternal complication Other maternal diseases of pregnancy Other maternal pathologies
8. Hypertension	**8.1 Chronic**		Pre-existing hypertensive disease Hypertension -Chronic hypertension: essential Hypertension -Chronic hypertension: secondary eg renal disease Hypertension -Chronic hypertension: unspecified
	8.2 Gestational hypertension/preeclampsia/eclampsia		Pregnancy-induced hypertension Hypertensive disorders of pregnancy Gestational hypertension Pre-eclampsia Pre-eclampsia toxaemia Maternal-severe preeclampsia and eclampsia Pre-eclampsia with laboratory evidence of thrombophilia Pre-eclampsia/eclampsia EPH-gestosis Pre-eclampsia superimposed on chronic hypertension Pre-eclampsia superimposed on chronic hypertension: With laboratory evidence of thrombophilia Severe pre-eclampsia/eclampsia HELLP Syndrome
	8.3 Unspecified hypertension		Hypertension Mother-hypertensive disorder (GHTN+APE+ preeclampsia) Unspecified hypertension
9. Infection	**9.1 Syphilis**		Congenital syphilis Perinatal infection –Bacterial- Spirochaetal e.g. syphilis
	9.2 Sepsis		Maternal sepsis Maternal infection/sepsis Sepsis of newborn due to anaerobes Bacterial sepsis of newborn
	9.3 Other specified	**9.3.1 Chorioamnionitis**	Ascending infection-chorioamnionitis Chorioamnionitis Other ascending infection Intra-amniotic infection of fetus, not elsewhere classified Spontaneous pre-term (membranes intact or rupture <24 hours before delivery) with chorioamnionitis on placental histopathology Spontaneous pre-term with membrane rupture >24 hours before delivery -With chorioamnionitis on placental histopathology Spontaneous pre-term with membrane rupture of unknown duration before delivery -With chorioamnionitis on placental histopathology Spontaneous pre-term with membrane rupture >24 hours before delivery -with clinical evidence of chorioamnionitis, no examination of placenta Spontaneous pre-term (membranes intact or rupture <24 hours before delivery) -With clinical evidence of chorioamnionitis, no examination of placenta Spontaneous pre-term with membrane rupture of unknown duration before delivery -With clinical evidence of chorioamnionitis, no examination of placenta
		9.3.2 Other	Congenital rubella syndrome

Category	Sub-category 1	Sub-category 2	Causes reported
			Group b streptococcus
			E Coli
			Listeria monocytogenes
			Bacterial
			Viral
			Maternal infection – viral
			Maternal infection – bacterial
			Maternal malaria
			Malaria
			Protozoa, e.g. toxoplasma
			All infections of term newborns, specific infections of the preterm (GBS, TORCH etc.).
			Fungal
			HIV
			Congenital CMV infection
			Cytomegalovirus
			Congenital viral disease, not otherwise specified
			Parvovirus
			Herpes simplex virus
			Unspecified viral
			Other specified organism
	9.4 Unspecified		Unknown infection
			Infection
			Infection (Fetal infection involving vital organs; Fetal membranes and placental inflammatory disorders; Fetal infection causing congenital anomaly or other fetal condition; Placental infection likely leading to decreased placental function; Severe maternal infection; Infection-related fetal death by other or unknown mechanisms)
			Congenital viral diseases
			Specified infections originating in the perinatal period
			Congenital pneumonia
			Syphilis and other venereal diseases
			Intrauterine infection
			Maternal infection
			Other unspecified organism
			Congenital syphilis, Congenital pneumonia, Intra-amniotic infection of fetus not elsewhere classified, Other specified infections specific to the perinatal period, Infection specific to the perinatal period, unspecified, Congenital viral diseases, Bacterial sepsis of newborn, Other congenital infectious and parasitic diseases
			Fetal infection
			Perinatal infection
			Other certain infectious and parasitic diseases
10. Hypoxic peripartum death	**10.1 Intrapartum complications**		Difficult labour
			Obstructed labour
			Prolonged labour
			Transverse lie
			Breech with stuck head
			Breech accidents
			Breech

Category	Sub-category 1	Sub-category 2	Causes reported
			Fetus and newborn affected by breech delivery and extraction Face presentation Malpresentation Fetus and newborn affected by abnormal presentation before labor Abnormal presentation Cephalopelvic disproportion Birth trauma Associated obstetric factors-intracranial haemorrhage Associated obstetric factors-birth injury to scalp Associated obstetric factors-fracture Injury occurred during birth Traumatic delivery Mismanaged labour Acute intrapartum event Intrapartum -prolonged/obstructed or incomplete labour Fetus and newborn affected by abnormal uterine contractions Fetus and newborn affected by caesarean delivery Fetus and newborn affected by other specified complications of labor and delivery Shoulder dystocia Fetus and newborn affected by obstetric complications and birth trauma Fetus and newborn affected by precipitate delivery Intrapartum complications Uterine rupture during labour
	10.2 Unspecified		Birth asphyxia Intrapartum-Fetal asphyxia Birth asphyxia with breech presentation Birth hypoxia Intrapartum asphyxia Fetal distress Intrapartum Acute intrapartum event Unexplained intrapartum fetal death Intrauterine hypoxia and birth asphyxia Hypoxic peripartum death Mild and moderate birth asphyxia Intrauterine hypoxia first noticed during labor and delivery "Remaining causes": Maternal care related to the fetus and amniotic cavity and possible delivery problems; Complications of labor and delivery; Encounter for delivery; Complications predominantly related to the puerperium All deaths related with asphyxia developing during labour and delivery. Labour and delivery complicated by stress /distress Hypoxic peripartum death; no intrapartum complications and no evidence of non-reassuring fetal status Hypoxic peripartum death; evidence of non-reassuring fetal status in a normally grown infant Newborn (suspected to be) affected by other complications of labor and delivery Fetus and newborn affected by other abnormal presentation,

Category	Sub-category 1	Sub-category 2	Causes reported
			malposition and disproportion during labor Intrapartum death Other specified intrapartum disorder Labour and delivery complicated by umbilical cord complications Fetus and newborn affected by complications of labor and delivery Intrauterine hypoxia first noted during labour and delivery; intrauterine hypoxia, unspecified; Birth asphyxia
11. Spontaneous preterm	**11.1 Preterm rupture of membranes**		Fetus and newborn affected by premature rupture of membranes Spontaneous pre-term with membrane rupture >24 hours before delivery Spontaneous pre-term with membrane rupture >24 hours before delivery -Without chorioamnionitis on placental histopathology Spontaneous pre-term with membrane rupture >24 hours before delivery -no clinical chorioamnionitis or examination of placenta Spontaneous pre-term with membrane rupture >24 hours before delivery -Unspecified or not known whether placenta examined Premature rupture of membranes
	11.2 Other preterm (includes timing of rupture unknown)		Prematurity Spontaneous preterm Spontaneous preterm labour Spontaneous premature labour Severe prematurity Extreme immaturity of newborn Prematurity (22-24 weeks) Spontaneous pre-term (membranes intact or rupture <24 hours before delivery) Spontaneous pre-term (membranes intact or rupture <24 hours before delivery) -Without chorioamnionitis on placental histopathology Spontaneous pre-term (membranes intact or rupture <24 hours before delivery) -No clinical signs of chorioamnionitis, no examination of placenta Spontaneous pre-term (membranes intact or rupture <24 hours before delivery) -Unspecified or not known whether placenta examined Spontaneous pre-term with membrane rupture of unknown duration before delivery -Without chorioamnionitis on placental histopathology Spontaneous pre-term with membrane rupture of unknown duration before delivery -No clinical signs of chorioamnionitis, no examination of placenta Spontaneous pre-term with membrane rupture of unknown duration before delivery -Unspecified or not known whether placenta examined Fetus and newborn affected by incompetent cervix Disorder related to short duration gestation and low birth weight Conditions related with premature birth: Hyaline membrane disease, intraventricular haemorrhage, non-specific infections of the preterm, deaths occurring four hours after premature delivery below and above 1000 g. Immaturity Prolonged rupture of membranes
12. Termination unspecified	**12.1 Termination of pregnancy for maternal psychosocial indications**		Termination of pregnancy for maternal psychosocial indications

Category	Sub-category 1	Sub-category 2	Causes reported
			Termination of pregnancy for suspected but unconfirmed congenital abnormality. Termination for maternal condition Family planning induction Induced abortion Medical abortion Termination of pregnancy, fetus and newborn
13. Other unspecified condition	**13.1 Unspecified**		Other (including multiple delivery, hypertension/eclampsia and post-term delivery) Miscellaneous (including maternal, placental, umbilical cord and intrapartum related conditions) Miscellaneous Post-maturity Post-dated Newborn post-term non-overweight for gestational age Obstetric complication 080 Fetus and newborn affected by obstetric complications and birth trauma Respiratory abnormalities Maternal care for other known or suspected fetal problems No obstetric antecedent-unknown/undetermined Other Other specific causes Other perinatal causes Other diseases Other sub-groups of causes Double etiologies Triple etiologies Remaining causes Other causes related to stillbirth Special reasons Remnants of malignant tumours Tumors: in situ, benign and of uncertain or unknown behavior and unspecified Fetus and newborn affected by maternal factors and by complications of pregnancy, labor and childbirth Fetal malnutrition without mention low weight or small for gestational age Complications of intrauterine procedures, not elsewhere classified Maternal or fetal hematologic conditions Macerated or nonmacerated stillbirths occurring before the onset of labour. Disorders related to prolonged pregnancy and overweight at birth Reduction defects of unspecified limb Other accident, poisoning or violence (postnatal) No obstetric antecedent -other specified Unspecified cause Intrapartum death of unspecified cause Other specified antepartum disorder Other or unspecified cause Use of herbs

Category	Sub-category 1	Sub-category 2	Causes reported
			Associated obstetric factors-other obstetric factors
			Other conditions originating in the perinatal period
			Other overweight newborns for gestational age
14. Unexplained	**14.1 Unexplained**		Unclassified-no relevant condition identified
			Unclassified -unidentified
			Unidentified causes
			Unexplained antepartum death-no placental pathology
			Unexplained antepartum death-no examination of placenta
			Unexplained antepartum death -other specified placental pathology
			Unexplained antepartum death -unspecified or not known whether placenta examined
			Cases with unexplained cause of mortality and other cases
			Unexplainable
			Unexplained
			Unexplained intrauterine death
			No obstetric cause/not applicable
			Unknown
			Unknown/no cause
			Unexplained antepartum
			No condition identified
			Unascertained cause of stillbirth
			Inconclusive
			Cause not identified
			Unexplained preterm (<37 weeks)
			Unknown/undetermined
			No antecedent or associated obstetric factors
			Unexplained-Macerated fetus
			Unexplained-Fresh
			Undetermined etiology
			Unclassified - Causes not found or proven
			Intrauterine hypoxia
			Intrauterine hypoxia first noted before onset of labor
			Intrauterine hypoxia, unspecified
			Intrauterine hypoxia/asphyxia
			Intrauterine hypoxia and birth asphyxia
			Antepartum hypoxia
			Intrauterine asphyxia
			Asphyxia not explained by any maternal condition
			Perinatal asphyxia
			Asphyxia/Hypoxia
			Normal fetus and placenta
			Hypoxia
	14.2 With associated risk factor/condition		Associated with obstetric complication
			Antecedents or associated factors present
15. Unable to classify			Missing (data)
			No data
			Either autopsy or histological examination of the placenta not performed
			Missing cause of death classification

Category	Sub-category 1	Sub-category 2	Causes reported
			Unexplained-pending post mortem or other investigation Unclassifiable Incomplete pathology examination or autopsy refusal Unclassified –no information available

Highlighted: non-lethal conditions

Table S2. Characteristics of included reports detailed

By country income-setting (n=85)

Country	Report	Data collected	Setting	Inclusion			SB rate per 1000	Cases occurring during report period			Data source	Examination rate (%)	
				Definition	TOP	Multiples		Total births	Total stillbirths	Stillbirths classified		Autopsy	Placental pathology
High-income countries													
Australia	Monk (2016)[1]	2011-12	Population /national	≥20 weeks or ≥400 g	yes	yes	7.3	614139	4485	3258	Systematic hospital audit; comprehensive investigation protocol	42.3	NS
Australia	Headley (2009)[2]	2005-08	Hospital /single centre	≥20 weeks or ≥400 g	yes	yes	7.2	11922	86	86	Systematic hospital audit; comprehensive investigation protocol	55.1*	92.1*
Canada	Public Health Agency of Canada (2013)[3]	2010	Population /national	≥500 g	yes	yes	5.1	238473	1220	1220	Vital statistics	NS	NS
Canada	Auger (2013)[4]	1981-2009	Population /regional	≥24 weeks	no	no	4.2	2407954	9983	7339	Birth registration	70.9	NS
Canada	Auger (2016)[5]	1981-2010	Population /regional	≥500 g	no	no	4.2	2424923	10172	9657	Birth registration	68.23	NS
Canada	Theriault (2016)[6]	2003-2012	Hospital /single centre	NS	NS	no	NS	NS	179	179	Systematic hospital audit; investigation protocol unclear	NS	100
Canada	Wou (2014)[7]	1989-2009	Hospital /single centre	≥500 g	no	yes	4.2	79410	332	289	Systematic hospital audit; investigation protocol unclear	76.0	100
Chile	National Committee on Vital Statistics (2015)[8]	2014	Population /national	≥22 weeks	NS	yes	8.5	253151	2154	2153	Birth registration	NS	
Croatia	Rodin (2014)[9]	2013	Population /national	≥22 weeks	yes	yes	3.9	40310	156	156	Vital statistics	NS	NS
Estonia	Health Statistics and Health Research Database (2016)[10]	2015	Population /NS	≥500 g or >22 weeks	NS	NS	3.8	14027	54	54	Death certificate	98.15	NS
France	Ego (2013)[11]	2000-10	Population /regional	≥22 weeks or ≥500 g	no	yes	3.8	186594	1030	1030	Retrospective regional study of routine birth data; unknown investigations	77.4^	77.4^
Hungary	Pasztor (2014)[12]	1996-2010	Hospital /single centre	≥24 weeks or ≥500 g	NS	yes	4.7	29897	140	140	Retrospective study using routinely collected hospital birth data	97.9	97.9
Ireland	Corcoran (2016)[13]	2014	Population /national	≥24 weeks or ≥500 g	yes	yes	4.2	67610	330	327	Systematic national audit; investigation protocol unclear	52	94.8

Country	Report	Data collected	Setting	Inclusion			SB rate per 1000	Cases occurring during report period			Data source	Examination rate (%)	
				Definition	TOP	Multiples		Total births	Total stillbirths	Stillbirths classified		Autopsy	Placental pathology
Ireland	Corcoran (2014)[14]	2011	Hospital /multi centre	NS	NS	NS	4.3	73953	318	236	Systematic national audit; investigation protocol unclear	NS	NS
Ireland	Doyle (2012)[15]	1999-2009	Population /regional	NS	NS	NS	3.9[$]	29487	115	101	Retrospective hospital audit using autopsy reports only	100	NS
Italy	Serena (2013)[16]	2006-11	Hospital /single centre	≥22 weeks or >500 g	NS	no	6.0[$]	31500	189	189	Systematic hospital audit; comprehensive investigation protocol	NS	NS
Italy	Nappi (2016)[17]	2010-13	Hospital /single centre	>22 weeks	no	yes	NS	NS	50	50	Systematic hospital audit; investigation protocol unclear	100	100
Japan	Koshida (2015)[18]	2007- 11	Population /regional	>22 weeks	NS	yes	3.8	66682	252	252	Retrospective clinical audit; investigation protocol unclear	2.7	NS
Japan	Statistics Bureau Japan (2016)[19]	2015	Population /national	>22 weeks	yes	yes	3.0	1008740	3063	3063	Vital statistics	NS	NS
Kuwait	Central Statistical Bureau (year unknown)[20]	2014	Population /national	≥28 weeks	NS	NS	7.1	61313	433	436	Vital statistics	NS	NS
Lithuania	Basys (year unknown)[21]	2015	Population /national	≥22 weeks	NS	yes	4.2	29019	123	123	Birth registration	NS	NS
New Zealand	PMMRC (2014)[22]	2012	Population /national	≥20 weeks or ≥400 g	yes	yes	7.9	62425	491	491	Systematic national audit; comprehensive investigation protocol	34.9	NS
New Zealand	Lu (2009)[23]	2004-07	Hospital /single centre	≥20 weeks or ≥400 g	yes	yes	10.3	29591	306	306	Systematic hospital audit; investigation protocol unclear	60.8	NS
Oman	Santosh (2013)[24]	2003-09	Hospital /single centre	>24 weeks	NS	yes	15.2	27668	244	244	Retrospective hospital audit; investigation protocol unclear	0	NS
Poland	Troszyński (2011)[25]	2007-09	Population /regional	≥500 g	NS	NS	4.0	614816	2225	2225	NS	NS	NS
Poland	Maciejewski (2014)[26]	2012	Hospital /multi centre	NS	NS	NS	3.9	157908	621	621	Retrospective hospital audit; investigation protocol unclear	NS	NS
Poland	Rzepkowska-Misiak (2012)[27]	2004-10	Hospital /single centre	≥22 weeks	NS	yes	7.3	11294	83	83	Retrospective hospital medical record audit; investigation protocol unclear	NS	NS
Portugal	Instituto Nacional de Estatica (2014)[28]	2012	Population /national	≥22 weeks	NS	NS	3.6	90168	327	327	Unknown[oo]	NS	NS
Portugal	Trocado (2015)[29]	2011-14	Hospital /single centre	≥24 weeks	NS	yes	3.2	6223	20	22	NS	NS	NS
Qatar	Qatar Statistics Authority (2010)[30]	2009	Population /national	≥28 weeks	NS	NS	6.7	18351	123	123	Death registry	NS	NS

Country	Report	Data collected	Setting	Inclusion			SB rate per 1000	Cases occurring during report period			Data source	Examination rate (%)	
				Definition	TOP	Multiples		Total births	Total stillbirths	Stillbirths classified		Autopsy	Placental pathology
Sweden	Stormdal Bring (2014)[31]	1998-2009	Population /regional	≥22 weeks	NS	no	4.1[$]	285238	1198	1089	Systematic regional audit; comprehensive investigation protocol	71.4	95.1
UK	Manktelow (2016)[32]	2014	Population /national	≥24 weeks	no	yes	4.2	782311	3252	3218	Systematic national audit; investigation protocol unclear	43.5	88.4
UK	Cockerill (2012)[33]	2009	Hospital /multi centre	NS	no	yes	5.2[$]	40962	229	213	Retrospective study using routinely collected national birth data; death certificates as the single source of information	29.6	76.1
UK	Heazell (2009)[34]	2006-07	Hospital /single centre	NS	no	yes	5.2[$]	13654	71	71	Retrospective hospital medical record audit; investigation protocol unclear	NS	54.0
UK	Gardosi (2010)[35]	2006-07	Hospital /multi centre	≥24 weeks	NS	NS	6.8	48357	328	328	Systematic regional audit; investigation protocol unclear	NS	NS
UK	Allanson (2016)[36]	1997-2010	Population /NS	≥24 weeks	NS	NS	4.2[$]	NS	4834	4834	Systematic regional audit; investigation protocol unclear	NS	NS
USA	Miller (2016)[37]	2009-13	Hospital /single centre	≥23 weeks	no	NS	NS	12000	144	144	Systematic hospital audit; comprehensive investigation protocol	72.0	100.0
Middle-income countries													
Argentina	Ministerio de Salud de la Nacion (2016)[38]	2015	Population /national	≥22 weeks	NS	NS	6.6	776204	5120	5120	Vital statistics	NS	NS
Brazil	Chiavegatto (2012)[39]	2000-09	Population /national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	NS	11.7	30134197	352992	334882	Death certificate	NS	NS
Bosnia Hercegovina	Fatusic (2013)[40]	NS	Hospital /single centre	NS	NS	NS	7.1	13960	99	99	Retrospective hospital audit; investigation protocol unclear	NS	NS
China	Zhu (2009)[41]	2005-08	population	>28 weeks or >1000 g	yes	NS	8.3[$]	159277	1357	1322	Unknown[oo]	Unknown[oo]	Unknown[oo]
China	Wan (2010)[42]	NS	hospital	>28 weeks or ≥1000 g	NS	NS	8.3[$]	12168	101	101	Unknown[oo]	Unknown[oo]	Unknown[oo]
China	Song (2012)[43]	2001-10	Hospital /single centre	>28 weeks or ≥500 g	NS	yes	8.3[$]	14819	123	110	Unknown[oo]	Unknown[oo]	Unknown[oo]
Colombia	Molina-Giraldo (2014)[44]	2010-13	Hospital /single centre	≥20 weeks or ≥500 g	no	yes	7.3	15408	112	51	Retrospective hospital audit; unknown investigations, 50% autopsy	45.5	NS
Colombia	DANE informacion Estadistica (2017)[45]	2016	Population /national	NS	NS	NS	8.1[$]	753086[$]	47442	47442	Birth and death registry	NS	NS

Country	Report	Data collected	Setting	Inclusion			SB rate per 1000	Cases occurring during report period			Data source	Examination rate (%)	
				Definition	TOP	Multiples		Total births	Total stillbirths	Stillbirths classified		Autopsy	Placental pathology
Costa Rica	The National Institute of Statistics (year unknown)[46]	2015	Population /national	NS	Unknown[oo]	NS	6.5	71819	466	466	Unknown[oo]	NS	NS
Ecuador	The National Institute of Statistics (2016)[47]	2015	Population /national	NS	yes	yes	6.6	275109	1829	1825	Vital statistics	NS	NS
Iran	Hadavi (2011)[48]	2006-07	Hospital /multi centre	>20 weeks	NS	NS	12.7	9969	127	61	Prospective hospital study; investigations unclear	NS	NS
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	2015	Population /national	≥20 weeks	yes	yes	6.9	2353596	16117	16115	Civil registry	NS	NS
Panama	National Institute of Statistics and Census (2014)[50]	2013	Population /national	≥5 months	NS	NS	9.8[$]	70714	693	694	Vital statistics	NS	NS
South Africa	Pattinson (2014)[51]	2012-13	Population /regional	≥500g	NS	NS	23.1	706177	21628	21630	Systematic regional audit; investigation protocol unclear	NS	NS
South Africa	Talip (2010)[52]	2006-07	Hospital /multi centre	>499 g	no	no	11.8	10369	123	123	Systematic hospital audit; investigation protocol unclear	NS	22.3[o]
South Africa	Allanson (2015)[53]	2013-14	Population /regional	≥1000 g or ≥28 weeks	NS	NS	17.7	23503	416	416	Systematic regional audit; investigation protocol unclear	0	0
Suriname	Bureau voor de statistikent (year unknown)[54]	2011	Population /national	≥28 weeks	NS	NS	14.3[$]	10209	146	146	NS	NS	NS
Thailand	Mo-suwan (2009)[55]	2000-02	Population /regional	≥28 weeks	NS	yes	6.8	3522	24	24	Prospective regional study medical records plus interviews; VA for deaths	N/A	N/A
Turkey	Duran (2016)[56]	2007	Hospital /single centre	>500 g and >22 weeks	NS	yes	22.0	16216	357	357	Prospective hospital study; investigations unclear	NS	NS
Turkey	Korkmaz (2010)[57]	2001-06	Hospital Single centre	≥22 weeks or ≥500 g	yes	yes	21.9	9990	219	219	Systematic hospital audit; investigation protocol unclear	61.2[o]	67.8[o]
Low-income countries													
Cameroon	Nkwabong (2012)[58]	2009-10	Hospital /single centre	≥28 weeks	NS	no	34.0	3998	136	136	Retrospective hospital audit; investigation protocol unclear. Little autopsy and placenta exam.	0	0
Ghana	Der (2016)[59]	2009-13	Hospital /single centre	≥1000g and ≥28 weeks or ≥35 cm	NS	yes	33.2	3641	121	121	Retrospective hospital audit; investigation protocol unclear	NS	NS

Country	Report	Data collected	Setting	Inclusion			SB rate per 1000	Cases occurring during report period			Data source	Examination rate (%)	
				Definition	TOP	Multiples		Total births	Total stillbirths	Stillbirths classified		Autopsy	Placental pathology
Ghana	Alhassan (2016)[60]	2010-12	Hospital /multi centre	≥1000g and >28 weeks	NS	no	22.2	3656	141	141	Retrospective regional study using routinely collected maternity data; investigation protocol unclear	0	NS
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	2015	Population /national	NS	NS	NS	8.0	391425	3121	3121	Birth registry	NS	NS
India	Bhattacharyya (2012)[62]	1999-2008	Hospital /single centre	≥28 weeks and >1000 g	NS	yes	33.7	156101	5257	4322	Retrospective hospital audit; investigation protocol unclear	NS	NS
India	Ujwala (2012)[63]	2005-07	Population /regional	NS	NS	yes	13.9	13467	159	105	Prospective cohort; VA	N/A	N/A
India	Angolkar (2012)[64]	2008-09	Population /regional	≥28 weeks	NS	NS	21.3[$]	657	14	14	Prospective cohort; VA	N/A	N/A
India	Abha (2011)[65]	2008	Hospital /single centre	>28 weeks and ≥1000g	NS	yes	21.3[$]	16338	348	348	Systematic hospital audit; comprehensive investigation protocol	NS	NS
India	Aggarwal (2011)[66]	2006-08	Hospital /single centre	≥24 weeks	NS	yes	21.3[$]	16573	353	225	Retrospective hospital audit; investigation protocol unclear	NS	NS
India	Kokila (2013)[67]	2008-10	Hospital /single centre	>28 weeks	NS	yes	98.2	2393	235	235	Retrospective hospital audit; investigation protocol unclear	NS	NS
Nigeria	Awoleke (2016)[68]	2012-14	Hospital /single centre	≥1000 g or ≥28 weeks or ≥35 cm	NS	NS	33.0	5408	178	178	Retrospective hospital audit; investigation protocol unclear	NS	NS
Nigeria	Ugwa (2014)[69]	2008-12	Hospital /single centre	≥28 weeks	NS	yes	169.9	4479	761	705	Retrospective hospital audit; investigation protocol unclear	NS	NS
Nigeria	Mutihir (2011)[70]	2006-07	Hospital Single centre	≥28 weeks	NS	NS	40.5	3904	158	133	Prospective hospital audit; investigation protocol unclear	NS	NS
Pakistan	Nausheen (2013)[71]	2006-08	Hospital /multi centre	>28 weeks	NS	yes	45.9	6848	315	204	Prospective regional audit (a non routine audit -with consent)- investigation not mentioned	NS	NS
Pakistan	Ashraf (2016)[72]	2013	Hospital /single centre	>28 weeks	NS	yes	28.4	440	125	125	Prospective hospital audit; investigation protocol unclear	NS	NS
Timor-Leste	Wilkins (2015)[73]	2010	Hospital /single centre	≥500 g or ≥22 weeks	yes	yes	29.0	5304	153	57	Birth registry	0	NS
Vietnam	Hirst (2012)[74]	2008-09	Hospital /single centre	>22 weeks or >500 g	yes	yes	26.0	4711	122	107	Prospective hospital audit; investigation protocol - baby and placental macroscopic exam.	0	0
Zambia	Turnbull (2011)[75]	2008-09	Population /regional	≥28 weeks	NS	yes	27.0	1852	50	50	Prospective cohort study; VA	N/A	N/A

Country	Report	Data collected	Setting	Inclusion			SB rate per 1000	Cases occurring during report period			Data source	Examination rate (%)	
				Definition	TOP	Multiples		Total births	Total stillbirths	Stillbirths classified		Autopsy	Placental pathology
Bangladesh	Baqui (2011)[76]	2003-05	Population /regional	≥7 months	NS	yes	36.6	48192	1748	1554	Prospective cohort study; VA	N/A	N/A
Ethiopia	Demise (2015)[77]	2012	Hospital /single centre	≥28 weeks and ≥1000 g	NS	NS	24.5	1225	30	33	Systematic hospital audit; with VA	NS	NS
Ethiopia	Yirgu (2016)[78]	2011	Population /regional	≥28 weeks	yes	yes	14.1	4097	57	57	Prospective cohort study; VA	N/A	N/A
Madagascar	Andriamandimbinson (2013)[79]	2011	Hospital /single centre	>22 weeks or ≥500 g	NS	yes	52.2	4308	225	224	Prospective hospital audit; investigation protocol unclear	NS	NS
Moldova	Uliana (2013)[80]	2005-11	Hospital /NS	NS	NS	NS	12.1[$]	11736	146	142	Retrospective hospital audit; investigation protocol unclear	NS	NS
Nepal	Pradhan (2010)[81]	1998-2007	Hospital /single centre	≥28 weeks	NS	no	16.0	5475	89	89	Retrospective hospital audit; investigation protocol unclear	0	NS
Nepal	Manandhar (2015)[82]	2012-13	Hospital /multi centre	≥22 weeks or ≥500 g	NS	NS	22.7	1147	26	25	Prospective cohort study; VA	N/A	N/A
Nepal	Manandhar (2010)[83]	2006-08	Population /regional	>28 weeks or >1000 g	NS	yes	31.3	25982	813	601	Prospective cohort study; VA	N/A	N/A
Nepal	Shrestha (2010)[84]	2007-08	Hospital /single centre	≥28 weeks and ≥1000g	NS	NS	13.5	816	11	11	Retrospective hospital audit; investigation protocol unclear	NS	NS
Guatemala, Pakistan, Zambia, DRC	Engmann (2011)[85]	2007-08	Population /regional	NS	NS	yes	30.0	9461	289	134	Prospective cohort study; VA	N/A	N/A

NS: Not stated; N/A: Not applicable; VA: verbal autopsy

**Rates reported separately for different cause of death; average rates presented*

^*Rate reported as Autopsy and/or placental investigations*

[o]*Rate reported for total perinatal death*

[$]*Stillbirth rate adapted from best available source; 1) report from comparable setting, 2) provided by author, 3) rate reported in Lawn et al [86]. Total births calculated from rate.*

[oo]*Unable to translate*

Blue highlight: Country representative report

Table S3: Classification systems for causes of stillbirth: Alignment with the ICD-PM

		ICD-PM alignment		
System name (or lead author if no name)	**Countries in which used (country of origin)**	**Requires distinguishing between AP and IP?**	**Allows fetal and maternal conditions?**	**Uses ICD codes?**
PSANZ-PDC[87]	Australia[1,2], New Zealand[22,23], Vietnam[74], Madagascar[79]	Partial	Yes	No
Codac[88]	UK[32g], Timor-Leste[73h], Canada[6]; (Norway)	Yes	Yes[i]	Yes
Manandhar[83]	Nepal[83]	Yes	No	No
PPIP[89]	South Africa[36,51j]	Partial	No	Unclear[k]
Irish NPEC[90]	Ireland[13,14l]	Yes	Yes	No
Wigglesworth[91]	Turkey[92], Nepal[82]; (UK)	Partial	No	No
Santosh[24f]	Oman[24]	No	No	No
Duran[56,93d]	Turkey[56]	Partial	No	No
INCODE[94]	USA[37m]	Partial	Yes	No
ReCoDe[95]	France[11], Cameroon[58n], Italy[17], Portugal[29], Nepal[81], India[96], UK[33-35]	Partial	Yes	No
Stockholm[97]	Sweden[31]	No	Yes	No
Serena (Aberdeen modification)[16o]	Italy[16]	Partial	No	No
Mo-Suwan[55]	Thailand[55]	Partial	No	No
Nausheen[71]	Pakistan[71]	Yes	No	Yes
Baqui[76,98e]	Bangladesh[76]	Yes	Yes[c]	No
Pattinson 1989[99]	Nigeria[68,70], South Africa[52]	Partial	No	No
Wou[7]	Canada[7]	Partial	No	No
Tulip[100]	Ireland[15]; (Netherlands)	No	No	No
Ujwala[63]	India[63]	Yes	No	No
Abha[65]	India[65]	Partial	No	No
Aggarwal[66]	India [66]	No	Yes	Yes

Notes: See[101] for details of alignment with characteristics for an effective global system. System characteristics adapted from[101,102]. PSANZ-PDC: Perinatal Society of Australia and New Zealand Perinatal Death Classification; PPIP: Perinatal Problem Identification Programme; ReCoDe: Relevant condition at death; INCODE: Initial Causes of Fetal Death; NPEC: National Perinatal Epidemiology Centre; Codac: Causes of death and associated conditions; ICD-PM: International Classification of Diseases for Perinatal Mortality.

[a] Defined as country of first affiliation of first author of first reference paper listed in source column. [c] If multiple cause/non-hierarchical approach is used; see Table S4. [d] Duran is likely a use of a Keeling modification of Wigglesworth that may have been first presented in Erdem. [e] Baqui is a major modification of Lawn 2009 Consistent Classification of Stillbirths. [f] Santosh states they use Wigglesworth but instead present a very substantial modification, most akin to, but still quite different from, Perveen[103] and Khanum[104]. [g] The use of Codac in this paper differs somewhat from how Codac is defined: for instance, in Table 13, the third level of "congenital anomalies" is slightly different from that in the Codac source document. [h] The use of Codac in this paper differs somewhat from how Codac is defined. One of the main causes they report is "maternal infection"; in Codac, "maternal" is a level 1 cause but "infection" is not a level 2 option under "maternal" (nor a level 3 option under "maternal other"); they also report a second main cause of "intrapartum fetal

asphyxia" which is listed as "intrapartum unknown" in Codac. [I] *But Manktelow 2016 does not seem to use the associated maternal conditions options provided by Codac, although it is referred to in annex A2.2.* [j] *The PPIP system has evolved since the 2002 source document from which this table's data was extracted. Importantly, the current South Africa reference document adds a 12th category: "No obstetric cause / Not applicable".* [k] *Although the 2002 PPIP document stated that PPIP categories are "based on ICD codes", the current South Africa reference document does not mention ICD.* [l] *There are a few differences between the Irish NPEC source document from which this table's data was extracted, and the current Ireland reference document; for instance, some different sub-categories under "congenital"; the latter document includes "unexplained" as a level 1 category while the former includes "no antecedent or associated obstetric factors" and "unclassified". Table 3.3 in the latter document lists level 2 causes which differ somewhat from those in the former; it seems this is a slight modification of the original source document.* [m] *This document includes a new category, "unknown".* [n] *This document has some differences with Recode in some of the Level 2 categories such as "maternal" and "umbilical".* [o] *A Recode modification is also presented but was not the source of data used in this paper.*

Table S4: Classification systems for causes of stillbirth: Selected characteristics

System name	Hierarchical?	SB vs NND categories?	Single cause?	# causes	# levels	Associated factors?	Associated factors vs causes?	Definitions?	Rules?	Alignment score with characteristics of an effective global system[101]
PSANZ-PDC[87]	Partly	No	Yes	7	4	Yes	Yes	Some	Yes	6/17
Codac [88]	Partly	Some	Yes	10	3	Yes	Yes	Some	Yes	9/17
Manandhar [83]	Unclear	Yes, all	Yes	10	1	No	n/a	Yes	No	3/17
PPIP[89]	No	Some	Yes[a]	12[a]	1	Yes	Yes	Some	No	4/17
Irish NPEC[90]	No	Some	Yes	12	3	Yes	No	Some	Yes	5/17
Wigglesworth[91]	No	Some	Yes	5	1	No	n/a	Some	Yes	5/17
Santosh[24]	No	Some	Yes	9	1	No	n/a	No	No	n/a[g]
Duran[56]	No	Some	Yes	7	1	No	n/a	No	No	n/a[g]
INCODE[94]	No	n/a[b]	No	7	4	No	n/a	Some	Yes	2/17
ReCoDe[95]	Yes	n/a[b]	No	9	2	Yes	No	Some	Yes	3/17
Stockholm[97]	No	n/a[b]	Yes	17	2	Yes	No	Yes	Yes	5/17
Serena[16]	No	n/a[b]	Yes	11	1	No	n/a	No	No	2/17
Mo-Suwan[55]	No	Yes	Yes	7	2	Yes	No	No	Yes	4/17
Nausheen[71]	Yes	n/a[b]	Yes	7	1	Yes	Unclear	Yes	Yes	3/17
Baqui[76]	Partly[d]	n/a[b]	Unclear[e]	2	2	Unclear[f]	No	Yes	Yes	n/a[g]
Pattinson 1989[99]	No	Some	No[c]	12	2	Yes	Yes	Yes	Yes	5/17
Wou[7]	Partly	n/a[b]	Yes	11	2	No	n/a	Some	No	0/17
Tulip[100]	No	No	Yes	6	3	Yes	Yes	Some	Yes	7/17
Ujwala[63]	No	Yes	Yes	2	2	No	n/a	No	No	6/17
Abha[65]	No	n/a[b]	Yes	9	2	No	n/a	No	No	2/17
Aggarwal[66]	Yes	n/a[b]	No	5, 11[g]	1	No	n/a	No	Yes	2/17

Notes: System characteristics adapted from[101,102]. SB vs NND categories: Includes separate categories for stillbirths and neonatal deaths; Single cause: Requires single cause to be identified; # causes: Number of causes at top level; Associated factors: Allows associated factors to be recorded; Associated factors vs causes: Requires associated factors and causes to be distinguished from one another; Definitions: Includes definitions for all causes; Rules: Includes guidelines for assigning cause of death

[a] When the system is used for stillbirths. [b] n/a: stillbirth-only system. [c] In the case of multiple birth fetal death; [d] Both hierarchical & non-hierarchical approaches allowed; [e] Both single & multiple cause approaches allowed; [f] Only if multiple cause approach is used; [g] Two formats are presented, one with 5 and one with 11 causes; [g] This system was not included in the assessment of alignment with characteristics for an effective global system, so no score is available.

Table S5. Major categories of causes of stillbirth

By income-setting (n=85)

	Causes of Stillbirth														
Report	**CA %**	**SFP %**	**FGR %**	**Plac %**	**APH %**	**Umb %**	**Mat %**	**Hyp %**	**Inf %**	**Hyp %**	**SP %**	**Other %**	**ToP %**	**Unex %**	**UnC %**
High-income countries															
Monk (2016)[1]	26.27	4.79	1.81	9.67	5.43	2.46	2.46	3.04	8.01	0.98	6.14	0.55	9.85	16.27	2.27
Headley (2009)[2]	30.23	8.14	9.30		6.98		2.33	3.49	6.98		19.77			12.79	
Public Health Agency of Canada (2013)[3]	8.44			22.87			4.75					35.08	26.23	2.62	
Auger (2013)[4]	11.34		6.32				1.46	3.19				51.85		25.85	
Auger (2016)[5]	13.58				13.86	10.78						38.26		23.53	
Theriault (2016)[6]	27.93	3.35		22.35		15.08	8.38		14.53					8.38	
Wou (2014)[7]	6.23	6.57	2.08	11.76	9.69	6.57	1.38	2.42	7.27	1.04				20.07	24.91
National Committee on Vital Statistics (2015)[8]	17.23	0.19	2.60	21.64			20.62		0.14	0.28				37.30	
Rodin (2014)[9]	10.90	8.97	1.92	20.51	12.82	7.05	4.49	5.13	14.10	0.64	5.13			8.33	
Health Statistics and Health Research Database (2016)[10]		1.85								96.30		1.85			
Ego (2013)[11]	13.79	3.01	35.92	5.53	7.09	6.31	1.46		6.70	1.17				9.90	9.13
Pasztor (2014)[12]	3.57	2.86		27.14	3.57	15.00			5.71					42.14	
Corcoran (2016)[13]	25.38	4.89	2.14	21.41	9.79	13.46	0.61	0.61	6.42	0.00	0.31			14.07	0.92
Corcoran (2014)[14]	35.17			22.88	14.83									27.12	
Doyle (2012)[15]	16.83			50.50										32.67	
Serena (2013)[16]	1.59				2.12		36.51	4.23	2.12	2.12		1.59		49.74	
Nappi (2016)[17]			6.00	42.00	10.00	4.00			22.00	2.00				14.00	
Koshida (2015)[18]	5.56	9.13	0.40		7.94	23.81			0.79		4.76			22.22	25.40
Japan National Report (2016)[19]	11.82	2.42	1.73						0.88	0.03	0.65	0.52		81.95	
State of Kuwait Central Statistical Bureau (NS)[20]	7.80	0.23		9.40			6.19				0.23			76.15	
Basys (NS)[21]	6.50			1.63						31.71		1.63		58.54	
PMMRC (2014)[22]	33.27	7.76	0.82	13.67	7.76	1.63	4.90	2.65	7.55	1.63	3.88		0.82	13.67	
Lu (2009)[23]	35.62	7.52	8.17		5.23		7.52	3.27	7.19	1.31	10.13			14.05	
Santosh (2013)[24]	18.85	6.97	11.07		13.11	11.89	6.97					9.02		22.13	
Troszyński (2011)[25]	25.71			17.08		7.55	5.03	2.29			3.73	13.71		24.90	

	Causes of Stillbirth														
Report	**CA %**	**SFP %**	**FGR %**	**Plac %**	**APH %**	**Umb %**	**Mat %**	**Hyp %**	**Inf %**	**Hyp %**	**SP %**	**Other %**	**ToP %**	**Unex %**	**UnC %**
Maciejewski (2014)[26]	9.98			12.08		9.98						30.27		37.68	
Rzepkowska-Misiak (2012)[27]	15.66			53.01	12.05	4.82			14.46						
Instituto Nacional de Estatica (2014) [28]	7.95	0.31	1.22							29.05		61.47			
Trocado (2015)[29]	9.09	18.18	9.09	9.09	18.18			9.09	9.09					18.18	
Qatar Statistics Authority (2010)[30]	11.38	0.81		6.50			2.44			1.63		0.81	0.81	75.61	
Stormdal Bring (2014)[31]	10.28	0.46		24.98	10.47	7.81	2.39	5.23	21.95	1.01		3.12		12.30	
Manktelow (2016)[32]	5.25	6.09		22.13		4.01	3.54		3.11	5.87				46.58	3.42
Cockerill (2012)[33]	9.39	8.45	44.13	2.82	8.45	0.94	4.23	0.47	1.41	1.41				17.84	0.47
Heazell (2009)[34]	12.68	2.82	40.85	5.63	2.82	5.63	2.82	2.82	2.82	1.41				19.72	
Gardosi (2010)[35]	17.99		42.99									39.02			
Allanson (2016)[36]	20.56		13.84						0.04	8.67		56.89			
Miller (2016)[37]	10.42			2.78			11.11		0.69			20.14		54.86	
Middle-income countries															
Ministerio de Salud de la Nacion (2016)[38]	6.95	17.87	1.93	20.92			4.18		0.02	24.92	0.37	22.83			
Chiavegatto (2012)[39]	4.49	0.22	0.49	20.54			13.79		0.56	1.27	0.52	3.27		54.84	
Fatusic (2013)[40]	10.10			17.17		13.13		17.17	5.05					37.37	
Zhu (2009)[41]	11.35				14.07	15.81				5.07			17.85	35.85	
Wan (2010)[42]	64.36					10.89	2.97	1.98	0.00	0.00	2.97			16.83	
Song (2012)[43]	21.95	9.76		0.81	11.38	8.13	13.01	26.83						8.13	
Molina-Giraldo (2014)[44]	19.61	7.84		19.61	3.92	5.88			21.57					15.69	5.88
DANE informacion Estadistica (2017)[45]	3.17	10.97	0.80				2.50		0.16		0.00				
The National Institute of Statistics (year unknown) [46]	8.58	86.48	4.51									0.43			
The National Institute of Statistics (2016)[47]	4.60	3.84	0.27	2.52	5.15	2.47	1.32	2.03	1.53	2.14	4.55	0.55	0.11	68.93	
Hadavi (2011)[48]	11.48				13.11			18.03			57.38				
Instituto Nacional de Estadistica y Geografia (2016)[49]	8.71	4.84	5.48	9.59	3.89	7.95	4.54	3.54	1.31	1.80	6.16	35.77		6.42	
National Institute of Statistics and Census (2014)[50]	6.34	0.14	0.43	21.04			3.31			2.88	4.47			61.38	
Pattinson (2014)[51]	3.15		2.33		14.78		2.79	18.26	3.13	9.65	9.84	1.23		34.84	
Talip (2010)[52]	10.57		21.95		20.33		4.07	3.25	17.89	8.13	1.63	0.81		11.38	

	Causes of Stillbirth														
Report	**CA %**	**SFP %**	**FGR %**	**Plac %**	**APH %**	**Umb %**	**Mat %**	**Hyp %**	**Inf %**	**Hyp %**	**SP %**	**Other %**	**ToP %**	**Unex %**	**UnC %**
Allanson (2015)[53]	2.88		0.96		16.35		2.16	23.56	1.68	15.87	1.20	0.72		34.62	
Bureau voor de Statistiken (year unknown)[54]	4.11		10.27				27.40					58.22			
Mo-suwan (2009)[55]	12.50	4.17			12.50	4.17	4.17		4.17	4.17				54.17	
Duran (2016)[56]	20.17	3.92							0.28	1.12	1.68	72.55		0.28	
Korkmaz (2010)[57]	5.02									25.11		10.05	42.47	17.35	
Ministerio de Salud de la Nacion (2016)[38]	6.95	17.87	1.93	20.92			4.18		0.02	24.92	0.37	22.83			
Chiavegatto (2012)[39]	4.49	0.22	0.49	20.54			13.79		0.56	1.27	0.52	3.27		54.84	
Low-income countries															
Nkwabong (2012)[58]	2.94	3.68			13.97	8.09	2.21	7.35	15.44	24.26				22.06	
Der (2016)[59]	3.31				16.53	4.13		1.65		18.18	8.26			47.93	
Alhassan (2016)[60]			4.26		9.93	12.77	6.38	6.38	9.93	16.31	3.55	5.67		24.82	
Instituto Nacional de Estadistica Guatemala (year unknown)[61]	6.38			4.61			4.20			1.06	2.21	0.96		80.58	
Bhattacharyya (2012)[62]	1.97				8.35	0.90	8.01		7.22	28.44	27.58	7.01		10.53	
Ujwala (2012)[63]	2.86	8.57					2.86				3.81	3.81		47.62	30.48
Angolkar (2012)[64]		7.14		57.14						14.29	14.29			7.14	
Abha (2012)[65]	4.31	22.41	11.49		12.64	4.02	12.07	20.69	2.01	0.57				9.77	
Aggarwal (2011)[66]	12.00	6.22			15.56		12.89	30.67		1.78	2.22	8.44		10.22	
Kokila (2013)[67]	4.26	6.81	4.68		25.53	5.11	1.70	27.66		19.57				4.68	
Awoleke (2016)[68]	6.74		0.56		11.24		3.37	17.42	2.81	41.57	2.81			13.48	
Ugwa (2014)[69]	1.42	14.33			17.73	6.24	11.21	13.33	8.94	23.55				3.26	
Mutihir (2011)[70]					21.05	8.27	8.27	15.04	12.78					34.59	
Nausheen (2013)[71]	9.31				24.02		3.43	12.75		34.31		16.18			
Ashraf (2016)[72]	4.80	8.00			16.80		3.20	15.20		22.40				29.60	
Wilkins (2015)[73]	14.04				12.28	5.26		21.05	15.79	29.82			1.75		
Hirst (2012)[74]	34.58	8.41	8.41		3.74		5.61	8.41			6.54			24.30	
Turnbull (2011)[75]	2.00			18.00		12.00		2.00	34.00				2.00	30.00	
Baqui (2011)[76]	1.93				6.44		1.03	7.01	13.58	20.53	2.77			46.72	
Demise (2015)[77]	33.33	6.06							6.06	39.39				15.15	
Yirgu (2016)[78]	5.26				15.79	1.75	3.51	15.79	14.04	15.79	12.28			15.79	

	Causes of Stillbirth														
Report	**CA %**	**SFP %**	**FGR %**	**Plac %**	**APH %**	**Umb %**	**Mat %**	**Hyp %**	**Inf %**	**Hyp %**	**SP %**	**Other %**	**ToP %**	**Unex %**	**UnC %**
Andriamandimbinson (2013)[79]	1.79	0.89	8.04		9.82		1.79	11.16	6.25	6.70	7.59	27.68		18.30	
Uliana (2013)[80]	14.08								23.24					62.68	
Pradhan (2010)[81]	5.62		11.24		5.62	5.62		17.98	6.74	12.36				34.83	
Manandhar (2015)[82]	8.00	4.00									28.00	48.00			12.00
Manandhar (2010)[83]	2.66	1.66					6.82				10.48	68.55			9.82
Shrestha (2010)[84]	9.09	9.09			9.09	9.09			27.27	36.36					
Engmann (2011)[85]					9.70	5.97	5.22		37.31	14.18	6.72	8.96		11.94	

CA: Congenital anomalies; SFP: Specific fetal/pregnancy pathology; FGR: Fetal growth restriction; Plac: Placental condition; APH: Antepartum haemorrhage; Umb: Umbilical cord condition; Mat: Maternal conditions, Inf: Infection; Hyp: Hypoxic peripartum death; SP: Spontaneous preterm; Other: Other unspecified condition; ToP: Termination of pregnancy; Unex: Unexplained; UnC: Unable to classify.

Table S6. Quality assessment detailed

Country-representative reports included in pooled estimates of global causes of stillbirth (n=33)

Report	Quality rating	1. Sample representative of the target population?	2. Data analysis conducted with sufficient coverage of the identified sample?	3. Study subjects and setting described in detail?	4. Objective, standard criteria used for the measurement of the condition?	5. Was the condition measured reliably?			
						5a. Adequate investigation of stillbirth?	5b. Adequate data source?	5c. Valid assignment?	Overall
Monk (2016)[1]	MEDIUM	Unclear	Yes	Yes	Yes	No	Yes	Yes	No
Public Health Agency of Canada (2013)[3]	LOW	Unclear	Yes	Yes	Yes	Unclear	No	No	No
National Institute of Statistics of Chile (2015)[8]	MEDIUM	Unclear	Unclear	Yes	Yes	Unclear	No	Yes	Unclear
Rodin (2014)[9]	MEDIUM	Unclear	Unclear	Yes	Yes	Unclear	Unclear	Yes	Unclear
Ego (2013)[11]	HIGH	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corcoran (2016)[13]	MEDIUM	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Statistics Bureau Japan (2016)[19]	LOW	Yes	Yes	Yes	Yes	Unclear	No	No	No
Kuwait National Report (year unknown)[20]	LOW	Unclear	Unclear	Yes	Yes	Unclear	No	No	No
Basys (year unknown)[21]	LOW	Unclear	Unclear	Yes	Yes	Unclear	Unclear	No	Unclear
PMMRC (2014)[22]	MEDIUM	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Troszyński (2011)[25]	LOW	Unclear	No	Yes	Yes	Unclear	Unclear	Yes	Unclear
Instituto Nacional de Estatica (2014)[28]	LOW	Unclear	Unclear	Yes	Yes	Unclear	Unclear	No	Unclear
State of Qatar Statistics Authority (2010)[30]	LOW	Unclear	Yes	Yes	Yes	Unclear	No	No	No
Stormdal Bring (2014)[31]	MEDIUM	Unclear	Yes	Yes	Yes	No	Yes	Yes	No
Manktelow (2016)[32]	LOW	Yes	No	Yes	Yes	No	Yes	No	No
Directorate of Health Statistics and Information (2016)[38]	LOW	Unclear	Unclear	Yes	Yes	Unclear	Unclear	No	Unclear

Report	Quality rating	1. Sample representative of the target population?	2. Data analysis conducted with sufficient coverage of the identified sample?	3. Study subjects and setting described in detail?	4. Objective, standard criteria used for the measurement of the condition?	5. Was the condition measured reliably?			
						5a. Adequate investigation of stillbirth?	5b. Adequate data source?	5c. Valid assignment?	Overall
Chiavegatto (2012)[39]	LOW	No	Unclear	Yes	Yes	Unclear	No	No	No
Zhu (2009)[41]	MEDIUM	Yes	Yes	Yes	Unclear	Unclear	No	Yes	Unclear
National Administrative Department of Statistics (2017)[45]	MEDIUM	Unclear	Unclear	Unclear	Yes	Unclear	No	Yes	Unclear
National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	MEDIUM	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Unclear
The National Institute of Statistics (2016)[47]	LOW	Yes	Unclear	Unclear	Yes	Unclear	No	No	No
Instituto nacional de estadistica y geografia (2016)[49]	LOW	Yes	Unclear	Yes	Yes	Unclear	Unclear	No	Unclear
Panama National Report (2014)[50]	LOW	Unclear	Unclear	Yes	Yes	Unclear	Unclear	No	Unclear
Pattinson (2014)[51]	MEDIUM	Unclear	Unclear	Yes	Yes	Unclear	No	Yes	Unclear
Bureau voor de statistikent (year unknown)[54]	LOW	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	No	Unclear
Mo-suwan (2009)[55]	LOW	No	No	Yes	Yes	Yes	Yes	No	Yes
Alhassan (2016)[60]	MEDIUM	Unclear	Yes	Yes	Unclear	No	Unclear	Yes	Unclear
Instituto Nacional de Estadistica Guatemala (year unknown)[61]	LOW	Unclear	Unclear	Unclear	Unclear	Unclear	No	No	No
Ujwala (2012)[63]	LOW	No	No	Unclear	Yes	Yes	Yes	Yes	Yes
Turnbull (2011)[75]	LOW	No	Yes	Yes	Unclear	Yes	Yes	Yes	Yes
Baqui(2011)[76]	MEDIUM	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yirgu (2016)[78]	LOW	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manandhar (2010)[83]	LOW	Unclear	No	Yes	Yes	Yes	Yes	No	Yes

Table S7. Pooled estimates of global causes of stillbirth

By country income setting (n=33)

	High-income countries (15 reports)			Middle-income countries (11 reports)			Low-income countries (7 reports)		
Causes of stillbirth	**# reports**	**Pooled estimate (95% CI)**	**95% PI**	**# reports**	**Pooled estimate (95% CI)**	**95% PI**	**# reports**	**Pooled estimate (95% CI)**	**95% PI**
Congenital anomalies	15	14.0% (9.9%, 18.7%)	1.1%, 37.6%	11	5.8% (4.7%, 7.1%)	2.2%, 10.9%	6	3.3% (1.3%, 5.9%)	0.1%, 14.6%
Specific fetal/pregnancy pathology	12	2.5% (1.2%, 4.3%)	0.1%, 12.0%	8	11.0% (3.7%, 21.4%)	0.1%, 57.8%	2	4.2% (0.1%, 13.6%)	-
Fetal growth restriction	8	3.8% (0.6%, 9.6%)	0.1%, 35.3%	9	2.0% (1.0%, 3.3%)	0.1%, 8.4%	-	-	-
Placental condition	13	14.4% (10.8%, 18.5%)	2.7%, 33.2%	5	13.7% (7.8%, 21.0%)	0.1%, 47.5%	2	9.6% (0.5%, 26.6%)	-
Antepartum haemorrhage	6	8.4% (6.2%, 10.8%)	2.3%, 17.8%	5	9.1% (3.4%, 17.03%)	0.1%, 47.4%	3	9.3% (4.9%, 14.8%)	0.1%, 92.1%
Umbilical cord condition	8	5.7% (3.7%, 8.0%)	0.5%, 15.7%	4	7.1% (2.7%, 13.2%)	0.1%, 45.1%	3	8.2% (2.3%, 17.1%)	0.1%, 99.9%
Maternal conditions	12	4.2% (2.0%, 7.2%)	0.1%, 20.4%	9	5.6% (2.0%,10.9%)	0.1%, 31.7%	6	3.8% (1.7%, 6.5%)	0.1%, 15.7%
Hypertension	6	2.9% (1.9%, 4.1%)	0.3%, 7.6%	3	6.5% (0.4%, 19.5%)	0.1%, 99.9%	4	7.0% (0.4%, 10.6%)	0.1%, 24.6%
Infection	9	6.1% (2.6%, 11.0%)	0.1%, 30.4%	7	0.6% (0.1%, 1.5%)	0.1%, 4.6%	4	15.8% (9.7%, 23.0%)	0.1%, 51.9%
Hypoxic peripartum death	11	3.6% (1.3%, 6.8%)	0.1%, 21.2%	8	5.2% (1.6%, 10.5%)	0.1%, 31.4%	4	11.6% (0.8%, 31.5%)	0.1%, 99.9%
Spontaneous preterm	7	2.3% (0.7%, 5.7%)	0.1%, 14.6%	6	3.5% (0.5%, 8.9%)	0.1%, 33.5%	6	4.8% (2.4%, 8.1%)	0.1%, 18.7%
Other unspecified condition	8	9.3% (1.8%, 21.6%)	0.1%, 66.8%	8	18.7% (0.9%, 51.5%)	0.1%, 99.9%	4	13.8% (0.1%, 61.0%)	0.1%, 99.9%
Terminations (unspecified)	4	6.9% (0.7%, 18.45)	0.1%, 81.5%	2	5.5% (0.1%, 34.5%)	-	-	-	-
Unexplained	14	31.2% (17.5%, 47.6%)	0.1%, 93.0%	7	43.7% (24.1%, 64.2%)	0.1%, 99.5%	6	41.0% (20.6%, 63.3%)	0.1%, 99.9%

CI: Confidence interval; PI: Prediction interval

Table S8. Unexplained stillbirth, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	16.3%	15.0%, 17.6%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	2.6%	1.8%, 3.7%	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	37.3%	35.3%, 39.4%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	8.3%	4.5%, 13.8%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	9.9%	8.2%, 11.9%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	14.1%	10.5%, 18.3%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3.0	3063	ICD	N/A	Low	82.0%	80.5%, 83.3%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	76.2%	71.9%, 80.1%	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	58.5%	49.3%, 67.4%	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	13.7%	10.8%, 17.0%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4.0	2225	ICD	N/A	Low	24.9%	23.1%, 26.8%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	75.6%	67.1%, 82.9%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	12.3%	10.4%, 14.4%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	46.6%	44.9%, 48.3%	
Summary						**19,261**				**31.6%**	**17.5%, 47.6%**	**0.1%, 93.0%**
Good Quality Only (n=7)						**8504**				**15.4%**	**8.5%, 23.8%**	**0.1%, 50.8%**
ICD (n=8)										**43.4%**	**19.0%, 69.6%**	**0.1%, 99.9%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Clinical (n=6)										**17.7%**	**7.1%, 31.9%**	**0.1%, 75.3%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	-	-	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	54.8%	54.7%, 55.0%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	35.9%	33.3%, 38.5%	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	68.9%	66.7%, 71.1%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	6.4%	6.1%, 6.8%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	61.4%	57.6%, 65.0%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	34.8%	34.2%, 35.5%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	54.2%	32.8%, 74.5%	
Summary						**431,203**				**43.7%**	**24.1%, 64.2%**	**0.1%, 99.5%**
Good Quality Only										-	-	-
ICD (n=4)										**45.7%**	**12.9%, 80.8%**	**0.1%, 99.9%**
Clinical (n=2)										**41.5%**	**24.1%, 60.1%**	**Insufficient data**
Low-income countries												

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	24.8%	17.9%, 32.8%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8.0	3121	NS	no	Low	80.6%	79.2%, 82.0%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	47.6%	37.8%, 57.6%	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	30.0%	17.9%, 44.6%	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	46.7%	44.2%, 49.2%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	15.8%	7.5%, 27.9%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary						**13,197**				**41.0%**	**20.6%, 63.3%**	**0.1%, 99.9%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical (n=2)										**46.8%**	**44.4%, 49.5%**	**Insufficient data**

Table S9. Other unspecified condition, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	0.6%	0.3%, 0.9%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	35.1%	32.4%, 37.8%	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	-	-	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	-	-	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	-	-	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	-	-	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	0.5%	0.3% 0.9%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	1.6%	0.2%, 5.8%	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	-	-	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	13.7%	12.3%, 15.2%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	61.5%	56.0%, 66.8%	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	0.8%	0.1%, 4.5%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	3.1%	2.2%, 4.3%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	-	-	
Summary										**9.3%**	**1.8%, 21.6%**	**0.0%, 66.8%**
Good Quality Only (n=2)						**4347**				**1.6%**	**0.1%, 5.1%**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=6)										**13.2%**	**1.6%, 33.2%**	**0.1%, 91.4%**
Clinical (n=2)										**1.6%**	**0.1%, 5.1%**	**Insufficient data**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	22.8%	21.7%, 24.0%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	3.3%	3.2%, 3.3%,	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	82.4%	82.0%, 82.7%	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	0.4%	0.1%, 1.5%	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	0.6%	0.3%, 1.0%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	35.8%	35.0%, 36.5%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	-	-	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	1.2%	1.1%, 1.4%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	58.2%	49.8%, 66.3%	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	-	-	
Summary										**18.7%**	**0.9%, 51.5%**	**0.1%, 99.9%**
Good Quality Only										-	-	-
ICD (n=6)										**17.7%**	**0.1%, 60.5%**	**0.1%, 99.9%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Clinical										-	-	-
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	5.7%	2.5%, 10.9%,	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	1.0%	0.7%, 1.4%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	3.8%	1.1%, 9.5%	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	-	-	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	-	-	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	68.6%	64.7%, 72.3%	
Summary										**13.8%**	**0.1%, 61.0%**	**0.1%, 99.9%**
Good Quality Only										-	-	-
ICD										-	-	-
Clinical (n=2)										**31.1%**	**0.1%, 95.2%**	**Insufficient data**

Table S10. Antepartum haemorrhage, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	5.4%	4.7%, 6.3%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	-	-	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	12.8%	8.0%, 19.1%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	7.1%	5.6%, 8.8%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	9.8%	6.8%, 13.5%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	-	-	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	7.8%	5.6%, 10.5%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	-	-	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	-	-	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	10.5%	8.7%, 12.4%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	-	-	
Summary										**8.4%**	**6.3%, 10.8%**	**2.3%, 17.8%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Good Quality Only (n=6)						**6351**				**8.4%**	**6.3%, 10.8%**	**2.3%, 17.8%**
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical (n=5)										**7.9%**	**5.8%, 10.3%**	**1.7%, 18.0%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	-	-	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	-	-	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	14.1	12.2%, 16.1%	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	5.2%	4.2%, 6.3%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	3.9%	3.6%, 4.2%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	-	-	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	14.8%	14.3%, 15.3%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	12.5%	2.7%, 32.4%	
Summary										**9.1%**	**3.4%, 17.0%**	**0.1%, 47.4%**
Good Quality Only										-	-	-

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=2)										**4.4%**	**3.3%, 5.7%**	**Insufficient data**
Clinical (n=2)										**14.1%**	**13.6%, 14.5%**	**Insufficient data**
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	9.9%	5.5%, 16.1%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	6.4%	5.3%, 7.8%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	15.8%	7.5%, 27.9%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										**9.3%**	**4.9%, 14.8%**	**0.1%, 92.1%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical										**Insufficient data**	**Insufficient data**	**Insufficient data**

Table S11. Infection, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	8.0%	7.1%, 9.0%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	0.1%	0.1%, 0.4%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	14.1%	9.1%, 20.6%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	6.7%	5.3%, 8.4%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	6.4%	4.0%, 9.7%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	0.9%	0.6%, 1.3%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	7.6%	5.4%, 10.3%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	-	-	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	-	-	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	22.0%	19.5%, 24.5%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	3.1%	2.5%, 3.8%	
Summary										**6.1%**	**2.6%, 11.0%**	**0.1%, 30.4%**
Good Quality Only (n=7)						**8504**				**7.90%**	**2.7%, 15.5%**	**0.1%, 43.9%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=3)										**2.5%,**	**0.3%, 6.4%**	**0.1%, 96.2%**
Clinical (n=6)										**8.3%,**	**4.1%, 13.7%**	**0.1%, 33.2%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	0.02%	0.1%, 0.11%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	0.6%	0.5%, 0.6%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	0.2%	0.1%, 0.2%	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	1.5%	1.0%, 2.2%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	1.3%	1.1%, 1.5%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	-	-	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	3.1%	2.9%, 3.4%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	4.2%	0.1%, 21.1%	
Summary										**0.6%**	**0.1%, 1.5%**	**0.1%, 4.6%**
Good Quality Only										-	-	-
ICD (n=5)										**0.5%**	**0.2%, 1.0%**	**0.1%, 3.0%**
Clinical (n=2)										**2.2%**	**2.0%, 2.5%**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	9.9%	5.5%, 16.1%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	34.0%	21.2%, 48.8%	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	13.6%	11.9%, 15.4%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	14.0%	6.3%, 25.8%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										**15.8%**	**9.7%, 23.0%**	**0.1%, 51.9%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical										**Insufficient data**	**Insufficient data**	**Insufficient data**

Table S12. Hypoxic peripartum death, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	1.0%	0.7%, 1.4%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	0.3%	0.1%, 0.6%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	0.6%	0.1%, 3.5%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	1.2%	0.6%, 2.0%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	-	-	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	0.3%	0.1%, 0.2%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	31.7%	23.6%, 40.7%	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	1.6%	0.7%, 3.2%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	-	-	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	29.1%	24.2%, 34.3%	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	1.6%	0.2%, 5.8%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	1.0%	0.5%, 1.8%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	5.9%	5.1%, 6.7%	
Summary										**3.6%**	**1.3%, 6.8%**	**0.1%, 21.2%**
Good Quality Only (n=6)						**8177**				**0.8%**	**0.5%, 1.3%**	**0.1%, 2.7%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=6)										**5.7%**	**0.7%, 14.7%**	**0.1%, 51.8%**
Clinical (n=5)										**1.9%**	**0.4%, 4.3%**	**0.1%, 16.1%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	24.9%	23.7%, 26.1%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	1.3%	1.2%, 1.3%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	5.1%	4.0%, 6.4%	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	2.1%	1.5%, 2.9%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	1.8%	1.6%, 2.0%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	2.9%	1.8%, 4.4%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	9.7%	9.3%, 10.1%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	4.2%	0.1%, 21.1%	
Summary										**5.2%**	**1.6%, 10.5%**	**0.1%, 31.4%**
Good Quality Only										-	-	-
ICD (n=5)										**4.7%,**	**0.9%, 11.1%**	**0.1%, 41.3%**
Clinical (n=2)										**8.8%**	**8.4%, 9.2%**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	16.3%	10.6%, 23.5%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	1.1%	0.7%, 1.5%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	20.5%	18.5%, 22.6%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	15.8%	7.5%, 27.9%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										**11.6%**	**0.8%, 31.5%**	**0.1%, 99.9%**
Good Quality Only										-	-	-
ICD										-	-	-
Clinical										**Insufficient data**	**Insufficient data**	**Insufficient data**

Table S13. Placental conditions, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	9.7%	8.7%, 10.7%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	22.9%	20.5%, 25.3%	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	21.6%	19.9%, 23.4%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	20.5%	14.5%, 27.7%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	5.5%	4.2%, 7.1%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	21.4%	17.1%, 26.3%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	-	-	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	9.4%	6.8%, 12.5%	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	1.6%	0.2%, 5.8%	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	13.7%	10.76%, 17.0%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	17.1%	15.5%, 18.7%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	6.5%	2.9%, 12.4%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	25.0%	22.4%, 27.7%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	22.1%	20.7%, 23.6%	
Summary										**14.4%**	**10.8%, 18.5**	**2.7%, 33.2%**
Good Quality Only (n=7)						**8504**				**16.0%**	**10.3%, 22.8%**	**0.9%, 43.9%**
ICD (n=7)										**13.7%**	**9.7%, 18.3%**	**2.4%, 31.8%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Clinical										**15.5%,**	**9.3%, 22.9%**	**0.3%, 46.9%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	20.9%	19.8%, 22.1%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	20.5%	20.4%, 20.7%,	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	2.5%	1.9%, 3.4%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	9.6%	9.1%, 10.1%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	21.0%	18.1%, 24.3%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	-	-	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	-	-	
Summary										**13.7%**	**7.8%, 21.0%**	**0.1%, 47.5%**
Good Quality Only										-	-	-
ICD (n=5)										**13.7%**	**7.8%, 20.1%**	**0.1%, 47.5%**
Clinical										-	-	-

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	-	-	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	4.6%	3.9%, 5.4%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	18.0%	8.6%,, 31.4%	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	-	-	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	-	-	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										**9.6%**	**0.5%, 26.6%**	**insufficient data**
Good Quality only										-	-	-
ICD										-	-	-
Clinical										-	-	-

Table S14. Congenital anomalies, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	26.3%	24.8%, 27.8%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	8.4%	6.9%, 10.2%	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	17.2%	15.7%, 18.9%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	10.9%	6.5%, 16.9%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	13.8%	11.7%, 16.0%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	25.4%	20.8%,30.5%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	11.8%	10.7%, 13.01%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	7.8%	5.5%, 10.7%	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	6.5%	2.9%, 12.4%	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	33.3%	29.1%, 37.6%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	25.7%	23.9%, 27.6%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	8.0%	5.3%, 11.4%	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	11.4%	6.4%,18.4%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	10.3%	8.5%, 12.2%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	5.3%	4.5%, 6.1%	
Summary										**14.0%**	**9.9%, 18.7%**	**1.1%, 37.6%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Good Quality Only (n=7)						**8504**				**19.00%**	**13.5%, 25.2%**	**3.2%, 43.7%**
ICD (n=9)										**11.7%**	**7.8%, 16.3%**	**1.0%, 31.1%**
Clinical (n=6)										**17.85,**	**8.9%, 29.0%**	**0.1%, 64.2%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	7.0%	6.3%,7.7%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	4.5%	4.4%, 4.6%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	11.4%	9.7%, 13.18%	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	3.2%	3.0%, 3.3%	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown	6.5	466	ICD	N/A	Medium	8.6%	6.2%, 11.5%	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	4.6%	3.7%, 5.7%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	8.7%	8.3%, 9.2%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	6.3%	4.6%, 8.4%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	3.2%	2.9%, 3.4%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	4.1%	1.5%, 8.7%	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	12.5%	2.7%, 32.4%	
Summary										**5.8%**	**4.7%, 7.1%**	**2.2%, 10.9%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Good Quality Only										-	-	-
ICD (n=7)										**5.9%**	**4.5%, 7.4%**	**1.8%, 12.0%**
Clinical										**5.5%**	**0.1%, 18.3%**	**Insufficient data**
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	-	-	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	6.4%	5.5%, 7.3%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	2.9%	0.6%, 8.1%	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	2.0%	0.1%, 10.7%	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	1.9%	1.3%, 2.7%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	5.3%	1.1%, 14.6%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	2.7%	1.2%, 4.3%	
Summary										**3.3%**	**1.3%, 5.9%**	**0.0%, 14.6%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical (n=3)										2.0%	1.5%, 2.7%	0.1%, 7.6%

Table S15. Specific fetal/ pregnancy pathology, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	4.8%	4.1%, 5.6%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	0.2%	0.1%, 0.5%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	9.0%	5.0%, 14.6%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	3.0%	2.1%, 4.2%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	4.9%	2.8%, 7.8%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	2.4%	1.9%, 3.0%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	0.2%	0.1%, 1.3%	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	7.8%	5.6%, 10.5%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	-	-	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	0.3%	0.1%, 1.7%	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	0.8%	0.1%, 4.5%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	0.5%	0.2%, 1.1%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	6.1%	5.3%, 7.0%	
Summary										**2.5%**	**1.2%, 4.3%**	**0.1%, 12.0%**
Good Quality Only (n=7)						**8504**				**3.40%**	**1.2%, 6.6%**	**0.1%, 19.2%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=6)										**1.3%**	**0.2%, 3.2%**	**0.1%, 11.4%**
Clinical (n=6)										**4.0%,**	**2.2%, 6.4%**	**0.1%, 15.1%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	17.9%	16.8%, 19.0%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	0.2%	0.20%, 0.23%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	11.0%	10.7%, 11.3%	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	86.5%	83.0%, 89.5%	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	3.8%	3.0%, 4.8%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	4.8%	4.5%, 5.2%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	0.1%	0.1%, 0.8%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	-	-	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	4.2%	0.1%, 21.1%	
Summary										**11.0%**	**3.7%, 21.4%**	**0.1%, 57.8%**
Good Quality Only										-	-	-
ICD (n=7)										**11.9%**	**4.1%, 23.1%**	**0.1%, 61.8%**
Clinical										**Insufficie**	**Insufficient**	**Insufficient**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical		nt data	data	data
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	-	-	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	8.6%	4.0%, 15.7%	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	-	-	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	-	-	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	1.7%	0.8%, 3.0%	
Summary										**4.2%**	**0.1%, 13.6%**	**Insufficient data**
Good Quality Only										**-**	**-**	**-**
ICD										**-**	**-**	**-**
Clinical (n=2)										**4.2%**	**0.1%, 13.6%**	**Insufficient data**

Table S16. Hypertension, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	3.0%	2.5%, 3.7%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	-	-	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	5.1%	2.2%, 9.9%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High		-	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	0.6%	0.1%, 2.2%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	-	-	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	2.7%	1.4%, 4.5%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	2.3%	1.7%, 3.0%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	-	-	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	5.2%	4.0%, 6.7%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	-	-	
Summary										**2.9%**	**1.9%, 4.1%**	**0.3%, 7.6%**
Good Quality Only (n=5)						**5321**				**3.0%**	**1.7%, 4.7%**	**0.1%, 10.3%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=2)										**3.2%**	**1.0%, 6.6%**	**Insufficient data**
Clinical (n=4)										**2.8%**	**1.5%, 4.5%**	**0.1%, 13.7%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	-	-	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	-	-	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	2.0%	1.4%, 2.8%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	3.5%	3.3%, 3.8%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	-	-	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	18.3%	17.7%, 18.8%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	-	-	
Summary										**6.5%**	**0.4%, 19.5%**	**0.1%, 99.9%**
Good Quality Only										-	-	-
ICD (n=6)										**2.8%**	**1.5%, 4.4%**	**Insufficient data**
Clinical										**Insufficient**	**Insufficient**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical		data	data	
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	6.4%	3.0%, 11.8%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	2.0%	0.1%, 10.7%	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	7.0%	5.8%, 8.4%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	15.8%	7.5%, 27.9%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										**7.0%**	**4.0%, 10.6%**	**0.1%, 24.6%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical										**Insufficient data**	**Insufficient data**	**Insufficient data**

Table S17. Fetal growth restriction, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	1.8%	1.4%, 2.3%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	2.6%	2.0%, 3.4%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	1.9%	0.4%, 5.5%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	35.9%	33.0%, 38.9%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	2.1%	0.9%, 4.4%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	1.7%	1.3%2.3%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	0.8%	0.2%, 2.1%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	-	-	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	1.2%	0.3%, 3.1%	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	-	-	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	-	-	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	-	-	
Summary										**3.8%**	**0.6%, 9.6%**	**0.1%, 35.3%**
Good Quality Only (n=6)						**7415**				**4.80%**	**0.2%, 14.4%**	**0.1%, 56.1%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=4)										**1.9%**	**1.4%, 2.6%**	**0.3%, 4.7%**
Clinical (n=4)										**6.4%**	**0.1%, 25.6%**	**0.1%, 99.9%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	1.9%	1.6%, 2.4%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	0.5%	0.5%, 0.5%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	0.8%	0.7%, 0.9%	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	4.5%	2.8%, 6.8%	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	0.3%	0.1%, 0.6%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	5.5%	5.1%, 5.8%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	0.4%	0.1%, 1.3%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	2.3%	2.1%, 2.5%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	10.3%	5.9%, 16.4%	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low		-	
Summary										**2.0%**	**1.0%, 33.4%**	**0.1%, 8.4%**
Good Quality Only										-	-	-
ICD (n=7)										**1.5%**	**0.6%, 2.9%**	**0.1%, 8.2%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Clinical										**Insufficient data**	**Insufficient data**	**Insufficient data**
Low-income countries[b]												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	-	-	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	-	-	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	-	-	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										-	-	-
Good Quality Only										-	-	-
ICD										-	-	-
Clinical										-	-	-

Table S18. Umbilical cord conditions, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	2.5%	2.0%, 3.1%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low		-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium		-	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	7.1%	3.6%, 12.3%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	6.3%	4.9%, 8.0%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	13.5%	10.0%, 17.6%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	-	-	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	1.6%	0.7%, 3.2%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	7.6%	6.5%, 8.7%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	-	-	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	7.8%	6.3%, 9.6%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	4.0%	3.4%, 4.8%	
Summary										**5.7%**	**3.7%, 8.0%**	**0.5%, 15.7%**
Good Quality Only (n=6)						**6351**				**5.8%**	**3.0%, 9.4%**	**0.1%, 22.1%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=2)										**7.4%**	**6.4%, 8.5%**	**Insufficient data**
Clinical (n=6)										**5.2%**	**3.1%, 7.8%**	**0.1%, 16.8%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	-	-	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	-	-	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	15.8%	13.9%, 17.9%	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	2.5%	1.8%, 3.3%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	8.0%	7.5%, 8.4%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	-	-	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	-	-	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	4.2%	0.1%, 21.1%	
Summary										**7.1%**	**2.7%, 13.2%**	**0.1%, 45.1%**
Good Quality Only										-	-	-
ICD (n=2)										**4.9%**	**0.9%, 11.6%**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Clinical										-	-	-
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	12.8%	7.7%, 19.4%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	12.0%	4.5%, 24.3%	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	-	-	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	1.8%	0.1%, 9.4%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										**8.2%**	**2.3%, 17.1%**	**0.1, 99.9%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical										-	-	-

Table S19. Maternal conditions, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	2.5%	2.0%, 3.1%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	4.8%	3.6%, 6.1%	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	20.6%	18.9%, 22.4%	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	4.5%	1.8%, 9.0%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	1.5%	0.8%, 2.4%	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	0.6%	0.1%, 2.2%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	-	-	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	6.2%	4.1%, 8.9%	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	4.9%	3.2%, 7.2%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	5.0%	4.2%, 6.0%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	2.4%	0.5%, 7.0%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	2.4%	1.6%, 3.5%	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	3.5%	2.9%, 4.2%	
Summary										**4.2%**	**2.0%, 7.2%**	**0.1%, 20.4%**
Good Quality Only (n=7)						**8504**				**4.1%**	**0.6%, 10.2%**	**0.1%, 36.4%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=6)										**6.6%**	**2.1%, 13.3%**	**0.1%, 39.0%**
Clinical (n=6)										**2.5%**	**1.6%, 3.4%**	**0.4, 6.2%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	4.2%	3.7%, 4.8%,	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	13.8%	13.7%, 13.9%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	2.5%	2.4%, 2.7%	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	1.3%	0.8%, 2.0%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	4.5%	4.2%, 4.9%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	3.3%	2.1%, 4.9%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	2.8%	2.6%, 3.0%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	27.4%	20.4%, 35.4%	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	4.2%	0.1%, 21.1%	
Summary										**5.6%**	**2.0%, 10.9%**	**0.1%, 31.7%**
Good Quality Only										-	-	-
ICD (n=6)										**4.3%**	**0.9%, 10.2%**	**0.1%, 35.8%**
Clinical (n=2)										**1.9%**	**1.7%, 2.1%**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	6.4%	3.0%, 11.8%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	4.2%	3.5%, 5.0%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	2.9%	0.6%, 8.1%	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	1.0%	0.6%, 1.7%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	3.5%	0.4%, 12.1%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	6.8%	4.9%, 9.1%	
Summary										**3.8%**	**1.7%, 6.5%**	**0.1%, 15.7%**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical (n=3)										**3.1%**	**0.2%, 8.9%**	**0.1%, 99.9%**

Table S20. Spontaneous preterm, detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	6.1%	5.3%, 7.0%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	-	-	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	-	-	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	5.1%	2.2%, 9.9%	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	-	-	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	0.3%	0.1%, 1.7%	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	0.7%	0.4%, 1.0%	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	0.2%	0.1%, 1.3%	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	3.9%	2.4%, 6.0%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	3.7%	3.0%, 4.6%	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	-	-	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	-	-	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	-	-	
Summary										**2.3%**	**0.7%, 4.7%**	**0.1%, 14.6%**
Good Quality Only (n=4)						**4232**				**3.4%**	**1.0%, 6.9%**	**0.1%, 28.6%**
ICD (n=4)										**1.8%**	**0.3%, 4.5%**	**0.1%, 23.6%**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Clinical (n=3)										**3.0%**	**0.5%, 7.3%**	**0.1%, 98.2%**
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	0.4%	0.2%, 0.6%	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	0.5%	0.5%, 0.5%	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	-	-	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	4.6%	3.6%, 5.6%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	6.2%	5.8%, 6.5%	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	4.5%	3.1%, 6.3%	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	9.8%	9.4%, 10.2%	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	-	-	
Summary										**3.5%**	**0.5%, 8.9%**	**0.1%, 33.5%**
Good Quality Only										-	-	-
ICD (n=5)										**2.6%**	**0.4%, 6.5%**	**0.1%, 26.8%**
Clinical										**Insufficient data**	**Insufficient data**	**Insufficient data**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	3.6%	1.2%, 8.1%	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	2.2%	1.7%, 2.8%	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	3.8%	1.1%, 9.5%	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	2.8%	2.0%, 3.7%	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	12.3%	5.1%, 23.7%	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	10.5%	8.2%, 13.2%	
Summary										**4.8**	**2.4, 8.1**	**0.0, 18.7**
Good Quality Only										-	-	-
ICD										**Insufficient data**	**Insufficient data**	**Insufficient data**
Clinical (n=3)										**5.3%**	**1.1%, 12.1%**	**0.1%, 99.9%**

Table S21. Terminations (unspecified), detailed pooled estimates

Country-representative studies (n=33)

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
High income countries												
Australia	Monk (2016)[1]	Population/ national	≥20 weeks or ≥400 g	yes	7.3	3258	PSANZ-PDC	Partly	Medium	9.9%	8.9%, 10.9%	
Canada	Public Health Agency of Canada (2013)[3]	Population/ national	≥500 g	yes	5.1	1220	ICD	N/A	Low	26.2%	23.8%, 28.8%	
Chile	National Institute of Statistics of Chile (2015)[8]	Population/ national	≥22 weeks	NS	8.5	2153	ICD	N/A	Medium	-	-	
Croatia	Rodin (2014)[9]	Population/ national	≥22 weeks	yes	3.9	156	ICD	N/A	Medium	-	-	
France	Ego (2013)[11]	Population/ regional	≥22 weeks or ≥500 g	no	3.8	1030	ReCoDe	yes	High	-	-	
Ireland	Corcoran (2016)[13]	Population/ national	≥24 weeks or ≥500 g	yes	4.2	327	Irish NPEC 2011	no	Medium	-	-	
Japan	Statistics Bureau Japan (2016)[19]	Population/ national	>22 weeks	yes	3	3063	ICD	N/A	Low	-	-	
Kuwait	Kuwait National Report (year unknown)[20]	Population/ national	≥28 weeks	NS	7.1	436	ICD	N/A	Low	-	-	
Lithuania	Basys (year unknown)[21]	Population/ national	≥22 weeks	NS	4.2	123	ICD	N/A	Low	-	-	
New Zealand	PMMRC (2014)[22]	Population/ national	≥20 weeks or ≥400 g	yes	7.9	491	PSANZ-PDC	Partly	Medium	0.8%	0.2%, 2.1%	
Poland	Troszyński (2011)[25]	Population/ regional	≥500 g	NS	4	2225	ICD	N/A	Low	-	-	
Portugal	Instituto Nacional de Estatica (2014)[28]	Population/ national	≥22 weeks	NS	3.6	327	ICD	N/A	Low	-	-	
Qatar	State of Qatar Statistics Authority (2010)[30]	Population/ national	≥28 weeks	NS	6.7	123	ICD	N/A	Low	0.8%	0.1%, 4.5%	
Sweden	Stormdal Bring (2014)[31]	Population/ regional	≥22 weeks	NS	4.1[$]	1089	Stockholm	no	Medium	-	-	
UK	Manktelow (2016)[32]	Population/ national	≥24 weeks	no	4.2	3218	Codac	Partly	Low	-	-	
Summary										**6.9%**	**0.7%, 18.4%**	**0.1%, 81.5%**
Good Quality Only (n=2)						**3749**				**4.2%**	**0.1%, 17.2%**	**-**

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
ICD (n=2)										**10.0%**	**0.1%, 46.0%**	**-**
Clinical (n=2)										**4.2%**	**0.1%, 17.2%**	
Middle-income countries												
Argentina	Directorate of Health Statistics and Information (2016)[38]	Population/ national	≥22 weeks	NS	6.6	5120	ICD	N/A	Low	-	-	
Brazil	Chiavegatto (2012)[39]	Population/ national	≥20 weeks or ≥500 g and/or ≥25 cm	NS	11.7	334882	ICD	N/A	Low	-	-	
China	Zhu (2009)[41]	Population	>28 weeks or >1000 g	yes	8.3[$]	1322	NS	no	Medium	17.9%	15.8%, 20.0%	
Colombia	National Administrative Department of Statistics (2017)[45]	Population/ national	NS	NS	8.1[$]	47442	ICD	N/A	Medium	-	-	
Costa Rica	National Institute of Statistics and Censuses Costa Rica (year unknown)[46]	Population/ national	NS	Unknown[oo]	6.5	466	ICD	N/A	Medium	-	-	
Ecuador	The National Institute of Statistics (2016)[47]	Population/ national	NS	yes	6.6	1825	ICD	N/A	Low	0.1%	0.1%, 0.4%	
Mexico	Instituto nacional de estadistica y geografia (2016)[49]	Population/ national	≥20 weeks	yes	6.9	16115	ICD	N/A	Low	-	-	
Panama	Panama National Report (2014)[50]	Population/ national	≥5 months	NS	9.8[$]	694	ICD	N/A	Low	-	-	
South Africa	Pattinson (2014)[51]	Population/ regional	≥500g	NS	23.1	21630	PPIP	no	Medium	-	-	
Suriname	Bureau voor de statistikent (year unknown)[54]	Population/ national	≥28 weeks	NS	14.3[$]	146	NS	no	Low	-	-	
Thailand	Mo-suwan (2009)[55]	Population/ regional	≥28 weeks	NS	6.8	24	Mo-Suwan	no	Low	-	-	
Summary										**5.5%**	**0.1%, 34.5%**	**-**
Good Quality Only										-	-	-
ICD										-	-	-
Clinical										-	-	-

Country	Study	Setting	Inclusion			Stillbirths classified	Systems		Study Quality	Point Estimate	95% C.I	95% P.I
			Definition	TOP	SB rate		System used	Hierarchical				
Low-income countries												
Ghana	Alhassan (2016)[60]	Hospital /multi centre	≥1000g and >28 weeks	NS	22.2	141	NS	no	Medium	-	-	
Guatemala	Instituto Nacional de Estadistica Guatemala (year unknown)[61]	Population/ national	NS	NS	8	3121	NS	no	Low	-	-	
India	Ujwala (2012)[63]	Population/ regional	NS	NS	13.9	105	Ujwala	no	Low	-	-	
Zambia	Turnbull (2011)[75]	Population/ regional	≥28 weeks	NS	27	50	NS	No	Low	-	-	
Bangladesh	Baqui(2011)[76]	Population/ regional	≥7 months	NS	36.6	1554	Baqui	Partly	Medium	-	-	
Ethiopia	Yirgu (2016)[78]	Population/ regional	≥28 weeks	yes	14.1	57	ICD	N/A	Low	-	-	
Nepal	Manandhar (2010)[83]	Population/ regional	>28 weeks or >1000 g	NS	31.3	601	Manandhar	Unclear	Low	-	-	
Summary										-	-	-
Good Quality Only										-	-	-
ICD										-	-	-
Clinical										-	-	-

Table S22. Mapping of stillbirth causes to the ICD-PM

33 reports; 454,533 stillbirths

	Fetal																							Maternal					
Category	Antepartum							Intrapartum								Unknown timing						No fetal cause	Total						Total
	A1	A2	A3	A4	A5	A6	A7	I1	I2	I3	I4	I5	I6	I7	I8	U1	U2	U3	U4	U5	U6			M1	M2	M3	M4	M5	
CA	0	0	0	0	0	0	0	0	0	0	0	3085	0	0	1	19238	0	104	0	0	53	118	22599	0	0	0	2045	20554	22599
SPF	0	0	0	0	0	0	0	0	0	0	0	779	0	0	23	4	0	5823	0	7	745	1282	8663	173	1070	9	37	7374	8663
FGR	0	0	0	0	0	0	0	0	0	0	0	0	1867	0	0	0	0	0	2263	0	0	0	4130	0	0	0	0	4130	4130
Plac	0	0	0	0	0	21	0	0	0	0	0	0	0	0	9	2	0	83	452	0	0	73884	74451	74432	0	0	17	2	74451
APH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4683	4683	4683	0	0	0	0	4683
Umb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2149	2151	2149	0	0	0	2	2151
Mat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	439	0	0	0	49691	50130	0	12584	0	37546	0	50130
HT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4915	4915	0	12	0	4903	0	4915
Inf	0	0	0	0	0	0	0	0	0	0	418	0	0	0	7	0	3182	0	0	0	2	291	3900	454	0	0	2061	1385	3900
Hyp	0	0	0	0	0	0	0	0	4	7075	0	0	0	1517	0	0	0	0	0	0	0	208	8804	0	13	4592	0	4199	8804
SP	0	0	0	0	0	0	0	0	0	0	0	0	2455	0	0	0	0	0	0	0	0	3047	5502	0	1071	2171	0	2260	5502
Other	0	0	0	0	0	8	0	0	39084	0	0	0	17	0	0	5	0	16861	187	2640	0	1	58803	0	140	39829	12	18822	58803
ToP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	885	0	0	0	0	885	0	0	0	0	885	885
Unex	0	0	90335	0	0	602	0	0	0	0	0	0	0	0	0	0	0	0	0	113558	0	50	204545	0	0	50	0	204495	204545
UnC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	372	0	0	372	0	0	0	0	372	372
Total	0	0	90335	0	0	631	0	0	39088	7075	418	3864	4339	1517	40	19249	3182	24197	2902	116577	800	140319	454533	81891	14890	46651	46621	264480	454533

APH: antepartum haemorrhage; CA: congenital anomalies; Fetal growth: disorders related to fetal growth; HT: hypertension; Hyp: hypoxic peripartum death; Inf: infection; FGR: fetal growth restriction; Mat: maternal condition; Other: other unspecified condition; Plac: placental conditions; SP: spontaneous preterm; SPF: specific fetal/placental condition; ToP: termination of pregnancy, unspecified; Umb: umbilical cord; UnC: unable to classify; Unex: unexplained

A1-6, I1-7, M1-5 as per ICD-PM[105]; A7 & I8: Other (ICD code not included in ICD-PM); U1: Unknown-congenital; U2: Unknown-infection; U3: Unknown-other specified disorder; U4: Unknown-disorders related to fetal growth; U5: Unknown-death of unspecified cause; U6: Unknown-Other (ICD code not included in ICD-PM)

Table S23. Stillbirth causes mapped to the ICD-PM matrix

33 reports; 454,533 stillbirths

Maternal condition	M1: Complications of placenta, cord and membranes	2: Matrnal complications of pregnancy	M3: Oher complications of labour and delivery	M4: Maternal medical and surgical conditions	M5: No maternal condition identified	Total
Antepartum						
A1: Congenital malformations, deformations and chromosomal abnormalities	0	0	0	0	0	0
A2: Infection	0	0	0	0	0	0
A3: Antepartum hypoxia	0	0	0	0	90335	90335
A4: Other specified antepartum disorder	0	0	0	0	0	0
A5: Disorders related to fetal growth	0	0	0	0	0	0
A6: Antepartum death of unspecified cause	21	0	0	8	602	631
A7: Other	0	0	0	0	0	0
Total	21	0	0	8	90937	90966
Intrapartum						
I1: Congenital malformations, deformations and chromosomal abnormalities	0	0	0	0	0	0
I2: Birth trauma	0	0	39084	0	4	39088
I3: Acute intrapartum event	0	13	4384	0	2678	7075
I4: Infection	418	0	0	0	0	418
I5: Other specified intrapartum	0	0	0	1919	1945	3864
I6: Disorders related to fetal growth	0	195	0	0	4144	4339
I7: Intrapartum death of unspecified cause	0	0	0	0	1517	1517
I8: Other	9	0	0	0	31	40
Total	427	208	43468	1919	10319	56341
Unknown timing						
U1: Congenital malformations, deformations and chromosomal abnormalities	0	0	0	0	19249	19249
U2: Infection	0	0	0	1806	1376	3182
U3: Other specified disorder	90	0	305	450	23352	24197
U4: Disorders related to fetal growth	435	0	0	17	2450	2902
U5: Death of unspecified cause	0	140	440	0	115997	116577
U6: Other	0	0	0	0	800	800
Total	525	140	745	2273	163224	166907
No fetal cause	80918	14542	2438	42421	0	140319
Total	81819	14890	46651	46621	264480	454533

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